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P.38

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// **ON THE COVER** // ILLUSTRATION BY ANDRE RUCKER.

ANDRE RUCKER (LEGO); JUAN DIEGO REYES (CRYPTO MINE); TREVOR RAAB (TOOLS); COURTESY KLIPSCH (HOME THEATER)

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1 My Pop Life

// EXPERT HACKS, GEAR RECS & LIFE-TESTED WISDOM FROM OUR MEMBERS //

RAFAEL O. QUEZADA, 72

General Contractor and Artist / Los Angeles, CA

"Whatever you can do or dream you can, begin it." –William Hutchinson Murray

FOOD FOR THOUGHT

Humanity's greatest deficiency is its basic nutrition. I'm the founder of The RootStock Foundation, which has worked with a local high school to develop Aquaponics and Spirulina greenhouses to impress on students the importance of nutrition. Knowing the difference between healthy and unhealthy diets can help improve social inequities and facilitate learning.

ART IN THE PARK

My early conceptual art sought to inspire action to preserve Earth's nature in the face of industrial exploitation. One of my first projects involved weaving massive planar forms in warehouses. They were like fishing nets, but with large spaces between the filaments. Once the woven elements were built, I collapsed and folded them to carefully move the pieces to park sites for installation. Dimensionally, the sculptures were enormous!

Famous Family

I'm so proud of my two nieces, Gabriela Quezada and Nina Bloomgarden, who are both in their own television series. Nina starred in *The Resort*, streaming on Peacock; Gaby is currently co-starring in a new series on The CW called *Walker Independence*. These beautiful young ladies are the sweetest.

I Can't Work Without…

Sketchup, a 3D modeling program, which helps me generate renderings for my company's contracting projects. I also use the measuring tool *Moasure* to give me an accurate context for lots with topographical features, so that infrastructure and foundation work can be realistically rendered.

EXISTENTIAL THOUGHTS

I want to learn how dark matter relates to dark energy in our universe and in a potential multiverse. I've also developed a strong sense that human intellect is not unique and is at work in countless settings and universes beyond our sight.

The King and I

In the 1970s, I upgraded the sound and light systems at the Ingalls Auditorium in Los Angeles. Not long after, I was asked to help integrate technology into Elvis's traveling show as a stage-technician roadie. My year on the road with Elvis was an experience outside any expectation I'd ever entertained. Working on The Elvis Show became a kind of calling card, opening doors to Hollywood celebrities large and small who'd heard I had the privilege of rigging the stages with sound and light systems for "The King."

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My Pop Life

// EXPERT HACKS, GEAR RECS & LIFE-TESTED WISDOM FROM OUR MEMBERS //

KEVIN FITZKE, 40

Wood Boat Builder and Designer / St. Paul, MN

Sometimes you have to jump into the deep end to learn to swim.

Current Passion Project

I've started building my first boat design, called "Miss Moonshine." It's a torpedo-shaped boat that's inspired by pre-war Grand Prix cars. My goal with Miss Moonshine is to redefine the Gentleman's Racer boat.

LEARNING TO BUILD

I grew up in my dad's woodshop building boat models and learning general woodworking. When I was a teenager, my dad bought me a boat design and building plans book that really opened the door to that world. For some reason, I've always been specifically fascinated with old wood boats.

Top Tools

With wooden boat building, so much is still done by hand, so investing in high-quality hand tools is worth every penny. My favorite brands are Veritas and Lie-Nielsen. And the handheld CNC technology of Shaper by Origin is a game changer for wooden boat building and designing.

We Should Really Remember...

Powerboat and airplane racing from the 1920s and '30s, which we've historically taken for granted. This era of daredevils and engineering paved the way for modern-day transportation. I find it amazing that back then, they could design and fabricate incredible things when the word "computer" wasn't part of our daily lives.

My Perfect Day

I enjoy being out in nature, whether I'm riding my bike, hiking, or just walking through the neighborhood with my dog, Hank, a mini-dachshund and beagle mix who loves to play catch. My wife and I are also big into antiques and vintage items—we love going to various antique stores.

LIFE AS AN ENTREPRENEUR

Like everything, there are good and bad days.

The biggest challenge with owning your own business (and being the only employee) is that you have to do everything—it makes for some long days. It's definitely easier to have assistance with certain business operations, but I don't have enough day-to-day business transactions to justify having someone help out. I might eventually need some help with the building and restoration side of things, but that will be a bridge I'll have to cross at a later point.

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WHAT SHOULD THE WORLD KNOW MORE ABOUT?

→ Pry open any *PopMech* editor's brain and you'll find an overstuffed assortment of fun facts, practical tips, interesting bits of history, and other insightful discoveries. But because there are only so many pages in this magazine, staffers don't always have the space to share their favorite, most underreported nuggets of knowledge. Until now.

RACING'S LIFESAVING INNOVATIONS

As *PopMech*'s autos editor, I wish more people were aware of the impact that racing has had on road vehicles. Sure, it's easy to dismiss the sport as just rich playboys having fun behind the wheel, but it's so much more than that. Automobiles are much safer today, thanks to breakthroughs that were born at the racetrack.

Think of disc brakes. Nearly all modern cars have them at all four corners, and now even the biggest, heaviest SUVs can stop on a dime. But things used to be different when drum brakes were the norm. These were far inferior to disc brakes and led to extended stopping distances. It's not rocket science that you'd want to stop as quickly as possible in an emergency situation; collisions at higher speeds result in much more energy—and therefore damage—to a vehicle and its passengers. It's just basic physics.

Take the Chevrolet Corvette. The folks at Chevy knew about the inherent safety and performance benefits of disc brakes as early as 1950, after Jaguar had defeated them at the 24 Hours of Le Mans with its largely superior disc-brake-equipped C Type and D Type race cars. But it wasn't until 1965 that disc brakes were a standard option on the Corvette. Believe it or not, a fair few buyers still weren't convinced and were eligible for a $64.50 credit if they wanted drum brakes fitted instead.

***Matt Crisara**, Gear Editor*

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2 Staff Meeting

Bottled Water B.S.

Tossing hundreds or thousands of empty water bottles into your recycling bin each year doesn't make up for the fact that you're using up that amount of plastic for a free, renewable resource in the first place. A May 2022 report from the nonprofit The Last Beach Cleanup and the advocacy group Beyond Plastics found just 5 to 6 percent of plastics in the U.S. are recycled. "Factoring in additional losses that aren't measured, such as plastic waste collected under the pretense of 'recycling' that are burned instead, the U.S.'s true plastic recycling rate may be even lower," the report states. "For example, plastic waste collected for 'recycling' is sent to cement kilns and burned in Boise, Idaho, and Salt Lake City, Utah."

This is not to discourage you from recycling. It's our duty to do the right thing, or else zero percent of our empty plastic water bottles would get a second chance at life. A huge component of this issue is the bottled-water industry, which has little to no incentive to use recycled plastics in its packaging.

"Greenwashing" public relations and marketing stunts further complicate matters, because they persuade consumers to feel better about their choices, believing that their plastic water bottles are environmentally friendly. In August 2021, for example, the nonprofit Earth Island Institute sued BlueTriton, one of the largest bottled-water companies in the world, over its misleading sustainability claims, stating that the company represented "deceptive trade practices." BlueTriton's lawyers moved to dismiss the case: "BlueTriton's representation of itself as 'a guardian of sustainable resources' and 'a company who, at its core, cares about water' is vague and hyperbolic," they said.

Courtney Linder, *Deputy Editor*

antenna wire along spine
microphone inside ear canal
transmitter embedded in cat's chest
DECLASSIFIED

A FAILED GOVERNMENT FELINE MISSION

Ever go to Wikipedia to quickly look something up about, I don't know, photosynthesis, and then hours later, you emerge as a leading expert on Hootie and the Blowfish? No? Just me? While the Great Wikipedia Rabbit Hole is a glorious waste of time, it occasionally yields some real breakthroughs—those knowledge bombs that can someday help you win a pub trivia night.

Like this one: In the 1960s, the CIA allegedly spent $20 million to implant microphones in cats' ear canals so the animals could inconspicuously eavesdrop on the Soviets. The disastrous first mission, in which a cat would mosey around the Soviet embassy in Washington, D.C., doomed the ill-conceived effort—codenamed "Acoustic Kitty"—from the start: "The cat was released nearby, but was hit and allegedly killed by a taxi almost immediately."

Acoustic Kitty was canceled in 1967, but it's my job to spread its failure far and wide.

Andrew Daniels,
Membership Director

PATHS HIDDEN IN PLAIN VIEW

If you've ever seen a makeshift dirt path connecting two sidewalks, that's a "desire path," also known as a desire line or game trail. These human- or animal-made trails often provide the shortest path from one place to another. Urbanists study them to improve pedestrian infrastructure. For example, colleges like Indiana and Michigan State intentionally leave newly built quads unpaved for a few months to see which paths students take before creating formal paths.

Many runners prefer to run on unpaved surfaces to reduce the impact on their legs, so sometimes you'll see a narrow dirt path on the shoulder of a trail. As a runner, these are my favorite desire paths. Keep an eye out for them—it's like a scavenger hunt!

Theo Kahler,
Membership Editor

GETTY IMAGES (BOTTLE); GETTY IMAGES/EYEEM (CAT); THOMAS HENGGE (PATH)

SACRED STONE OF THE SOUTHWEST IS ON THE BRINK OF EXTINCTION

Centuries ago, Persians, Tibetans and Mayans considered turquoise a gemstone of the heavens, believing the striking blue stones were sacred pieces of sky. Today, the rarest and most valuable turquoise is found in the American Southwest— but the future of the blue beauty is unclear.

On a recent trip to Tucson, we spoke with fourth generation turquoise traders who explained that less than five percent of turquoise mined worldwide can be set into jewelry and only about twenty mines in the Southwest supply gem-quality turquoise. Once a thriving industry, many Southwest mines have run dry and are now closed.

We found a limited supply of turquoise from Arizona and purchased it for our ***Sedona Turquoise Collection***. Inspired by the work of those ancient craftsmen and designed to showcase the exceptional blue stone, each stabilized vibrant cabochon features a unique, one-of-a-kind matrix surrounded in Bali metalwork. You could drop over $1,200 on a turquoise pendant, or you could secure 26 carats of genuine Arizona turquoise for **just $99**.

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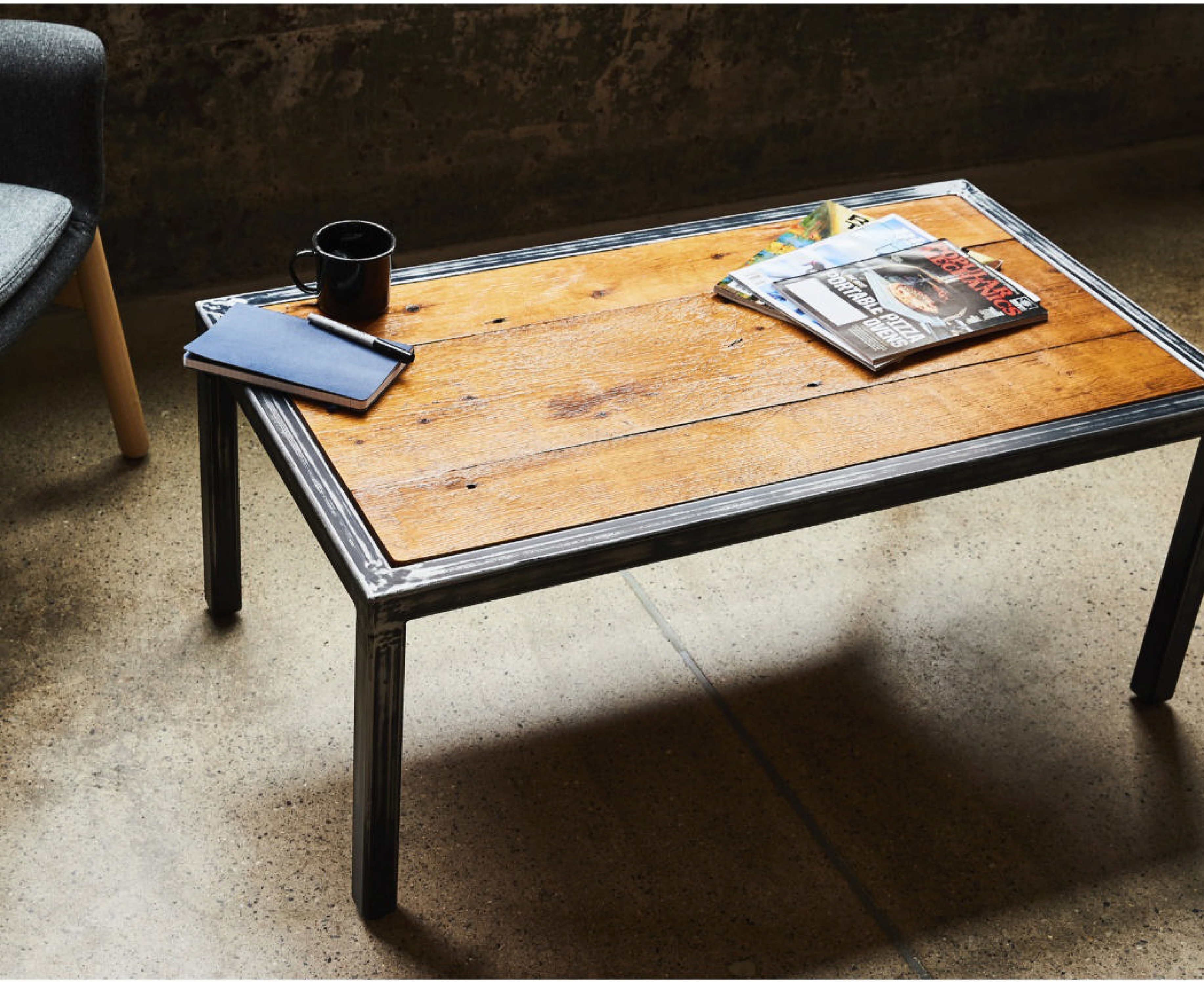
// BY BRADLEY FORD //



TREVOR RAAB

A Handsome Industrial Coffee Table for Less Than $200

YOU'VE SEEN THE ADS AND CATALOGS HAWKING TRENDY FURniture featuring pseudo-repurposed materials for gobs of money. If you've ever wondered *How hard could it be to make that?* or *How much would it really cost to make that?* we've got answers: not all that hard, and not all that much. And we can point you in the right direction to build an industrial-style coffee table that will cost between $50 and $200—depending on your choice of materials or what you might already have on hand.

The most specialized tool you'll need is a welder. If you don't have one, you can get a 110-volt welder that will do the trick for around $100. Welding takes a little practice, so get some scrap metal to warm up on before you start the project. The good news is that we're just making a coffee table, so you only have to get two pieces of metal to stick together well enough to support a coffee cup and magazines. And don't worry about how your welds look; you'll be able to clean them up with an angle grinder.

CUT THE SQUARE TUBING FOR THE COFFEE TABLE FRAME

You can use any size of square tubing you like. I chose tubing that was 1½ inches square because I liked the proportions for the size of this table. Of course, you can also make a larger or smaller table, and the steps will still be the same. You can cut steel tubing with a hacksaw, a handheld band saw, a reciprocating saw, or an abrasive chop saw—just be sure to use an appropriate blade for the tubing you're cutting.

- Measure and cut the four pieces of square tubing for the coffee table top [1]. You'll need two lengths at 40 inches long and two at 22 inches long.
- Mark and cut both ends of all four pieces at a 45-degree angle so they'll fit together like a picture frame.
- Use an angle grinder to bevel both ends of each piece [2]. When the pieces are butted together, this will allow the bead of weld to get good penetration in both pieces of metal.
- Fit the pieces together and make sure the joints don't have any big gaps. If they do, use an angle grinder to remove high spots and close the gaps.
- Make sure the tubing joints are square.
- Mark and cut four pieces of tubing, each 15 inches long, for the coffee table legs.
- Then use an angle grinder to create a bevel on both ends of each leg.

WELD THE COFFEE TABLE FRAME

To weld the steel tubing, you can use 110-volt MIG, a flux-core wire feed, or a stick welder. MIG welding will require the least cleanup, but you can weld just as well with the other two types—you'll just need to knock all the slag off the weld. When tacking, you should jump diagonally across your work

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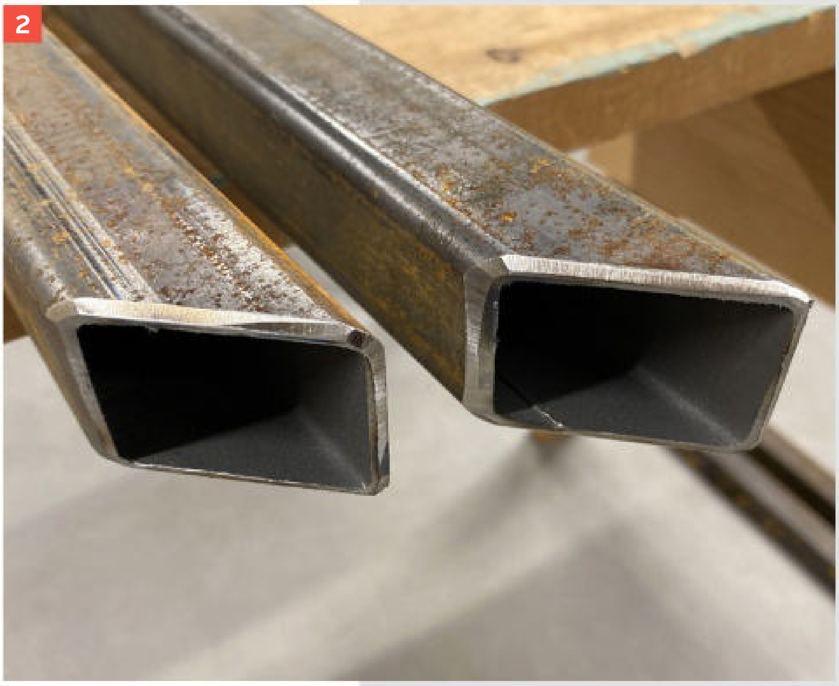
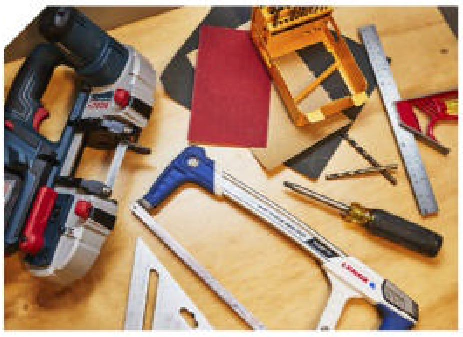


BRAD FORD (STEPS); TREVOR RAAB (TOOLS)



MATERIALS AND TOOLS

MATERIALS

☐ 16 feet of 1½" x 1½" steel tubing
☐ 4 feet of 1½" x ⅛" flat steel stock
☐ ¼"-20 leveling feet (x4)
☐ About 12' of boards for the tabletop (depending on the width)
☐ Your choice of spray paint
☐ ¼"-20 screw or bolt (x4)
☐ ¼"-20 T-nuts (x4)
☐ Miscellaneous screws

TOOLS

☐ Miter saw
☐ Metal-cutting saw (hacksaw, handheld band saw, etc.)
☐ Welder
☐ Welding magnets
☐ Angle grinder
☐ Metal files
☐ Drill
☐ Drill bits
☐ Sandpaper
☐ Square
☐ Screwdrivers

3 Build It

to prevent putting too much heat into one place, which can cause the parts to warp out of square.

- Square up the tubing for the tabletop [3]. You can use welding magnets to hold everything in place.
- Tack-weld the outside corners first.
- Tack-weld the top of the inside corners, then flip the frame over and tack the inside corners on the other side.
- Now you can fully weld the outside corners. Do one corner and move to the next diagonally opposite, then do the other two.
- Weld the top of each joint [4]. Do one corner and move to the next diagonally opposite, then do the other two.
- Stand the frame up to weld the inside corners. Remove the magnets and use them to help hold the frame upright. Do one corner and move to the next diagonally opposite, then do the other two.
- Use an angle grinder to clean up the welds—unless you made beautiful welds you want to show off. (Someone once told me, "If you're not a good welder, you better be a good grinder.") Don't worry about making things perfect—part of the charm of furniture like this is the worn, distressed finish [5].
- Grind off as little material as you can so you don't leave depressions in the metal.
- Use the welding magnets and a straightedge to line up the legs and hold them in place.
- Make sure you have each leg aligned to both sides of the tabletop. Tack-weld the outside corner first, followed by the inside corner, then do the right and left. Repeat for the other three legs.
- Once the leg is tacked in place, weld one side at a time, doing opposing sides first. Repeat for the other three legs.
- Use the angle grinder to clean up the welds, followed by a file to smooth out the edges and corners.

ADD A BRACKET FOR THE COFFEE TABLE TOP

Once your frame is built, you'll need to add a bracket on each end to attach the tabletop. Grab a scrap of the top material to use as a spacer to get the bracket in the right place.

- Clamp a random piece of wood or metal across the top of the frame on one end—this will keep the coffee table top from sticking up above the frame.
- Lay the top material scrap on the wood/metal.

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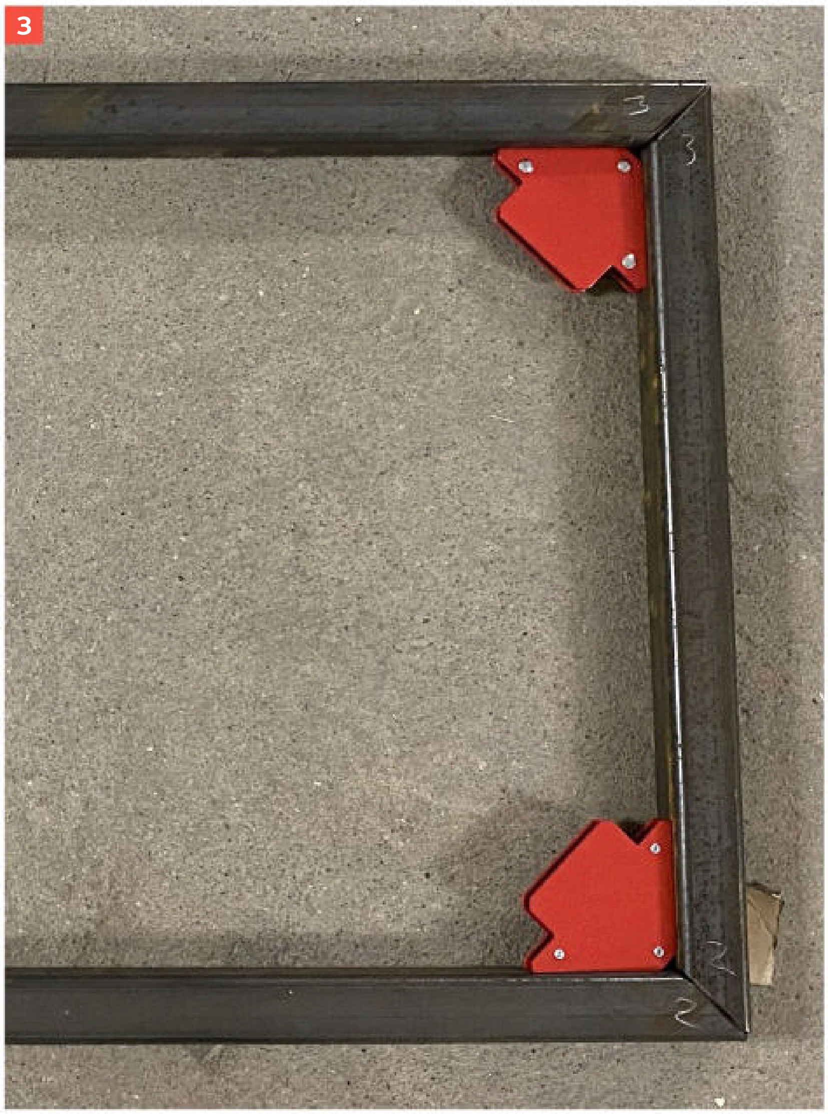

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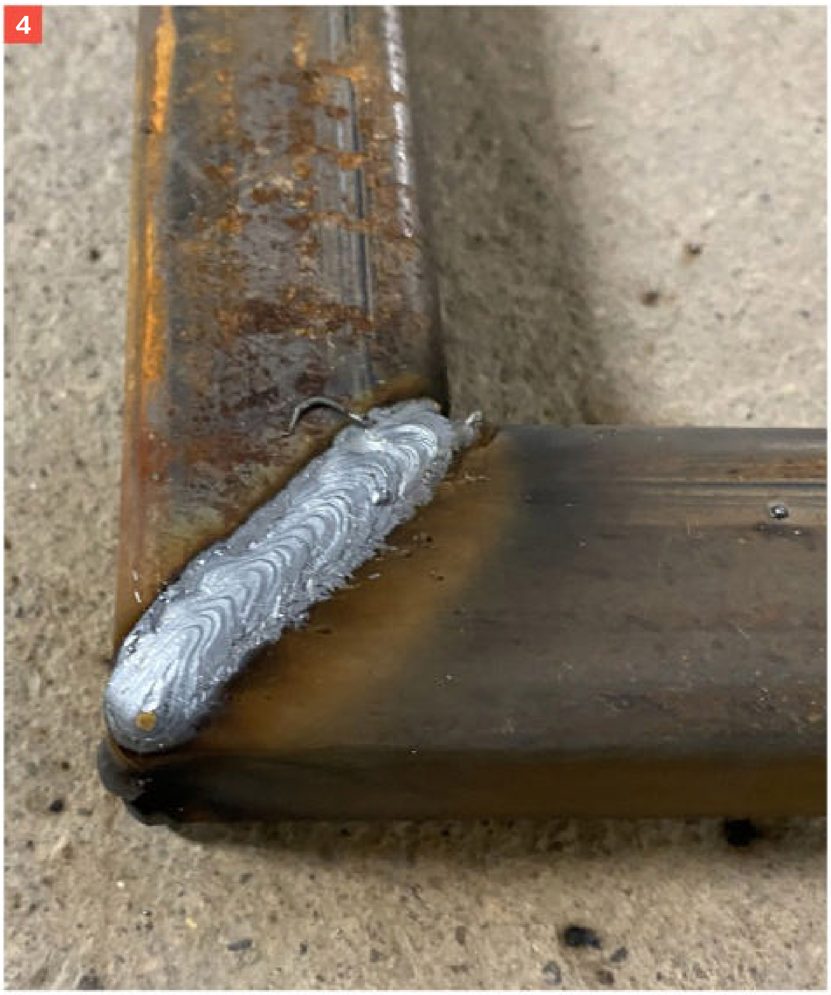

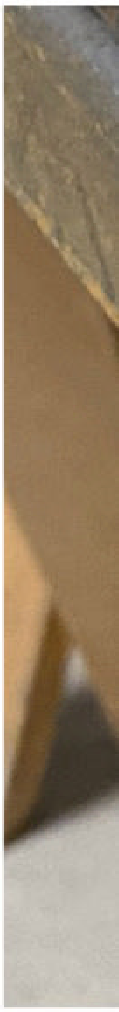

BRAD FORD

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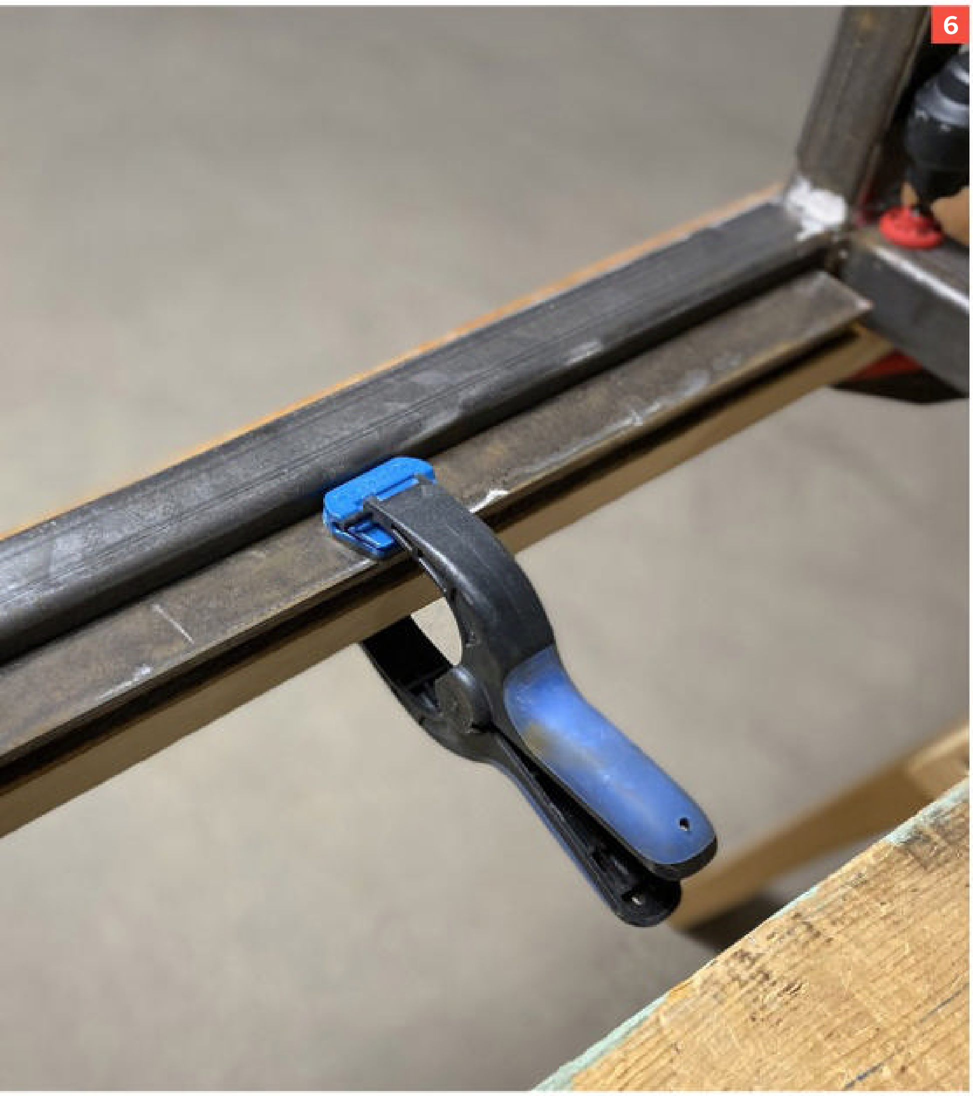

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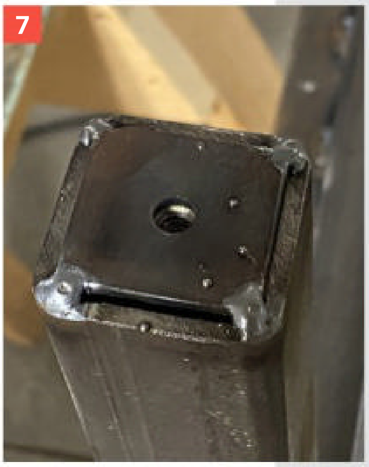

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- Clamp an 18-inch piece of flat steel stock on top of your wood/metal scrap so that it's flush against the end of the frame [6].
- Weld five 1-inch beads to attach the flat stock to the frame. Repeat the process on the other end of the coffee table frame.
- Flip the coffee table over. Mark and drill four ¼-inch holes, evenly spaced, in each bracket.

CAP THE LEGS

- Cut four 1¼ x 1¼-inch squares of flat steel stock and drill a ¼-inch hole in the center of each.
- Thread ¼-inch-20 screws or bolts through the squares and into the T-nuts to hold them in place.
- Tack-weld the T-nuts to the square leg caps, then remove the screws holding them together.
- Center the caps on the legs with the T-nuts on the inside. Tack-weld the caps to the legs, doing opposing corners first [7].
- Weld the caps, one side at a time, doing the opposing sides first.
- Clean up the welds with an angle grinder, followed by a file for the finer bits [8].

PREPARE THE COFFEE TABLE TOP

Just about anything can work for your coffee table top. I had 100-plus-year-old tongue-and-groove flooring from an old farm building that I wanted to use. You could go to a lumberyard and get ¾-inch oak, maple, or pine if you want. You could even use a scrap of granite countertop—just make sure you account for the thickness when you weld the top brackets to the coffee table frame.

→ Before you start cutting your wood for the top, measure the inside of your frame. After I welded mine together, it measured 18⅞ by 36⅞ inches.

Build It

Subtract ⅛ inch from the width and length so that the top will fit in with a slight gap all the way around. The top for ours needed to be 18¾ by 36¾ inches. So that meant I cut these boards to 36¾ inches long.

- Since my boards are 9 inches wide, I wanted one whole board centered, with narrower boards of equal width on each side. I cut the outside boards down to 4⅞ inches wide, not including the tongue, since that slips into the groove on the next board. You'll need to lay out your top according to the material you choose to use. Round the outside corners slightly so the top drops easily into the frame [9].
- Fit your top pieces into the frame and flip the coffee table over. Cut two strips of wood each about 2½ inches wide to span across the bottom of your tabletop. Cut the ends at a 45-degree angle—this will ensure they won't be seen from the side and detract from the look.
- Screw the boards across the bottom of your tabletop, about 9 inches from each end [10].
- Flip the coffee table back over to check the fit. Now you can finish the tabletop any way you like. I lightly sanded the salvaged boards, used a similar color stain on the fresh cuts on the edges, and then applied one coat of semi-gloss polyurethane.
- Before you screw the top on from the bottom, wedge a small piece of cardboard between the top and frame on each side [11]. This will center the top with an even gap all the way around.
- Screw your coffee table top on to secure the fit before moving to the final stage.

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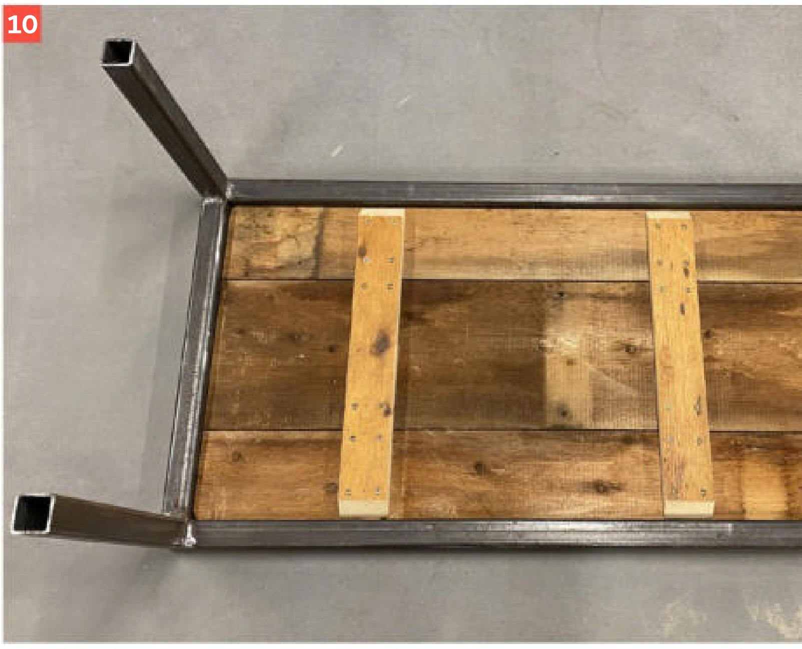

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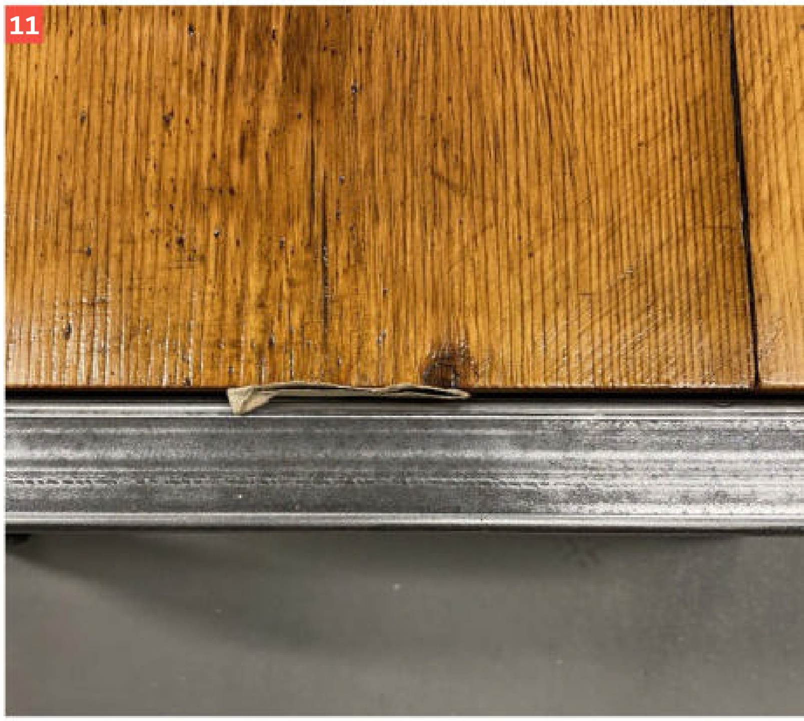

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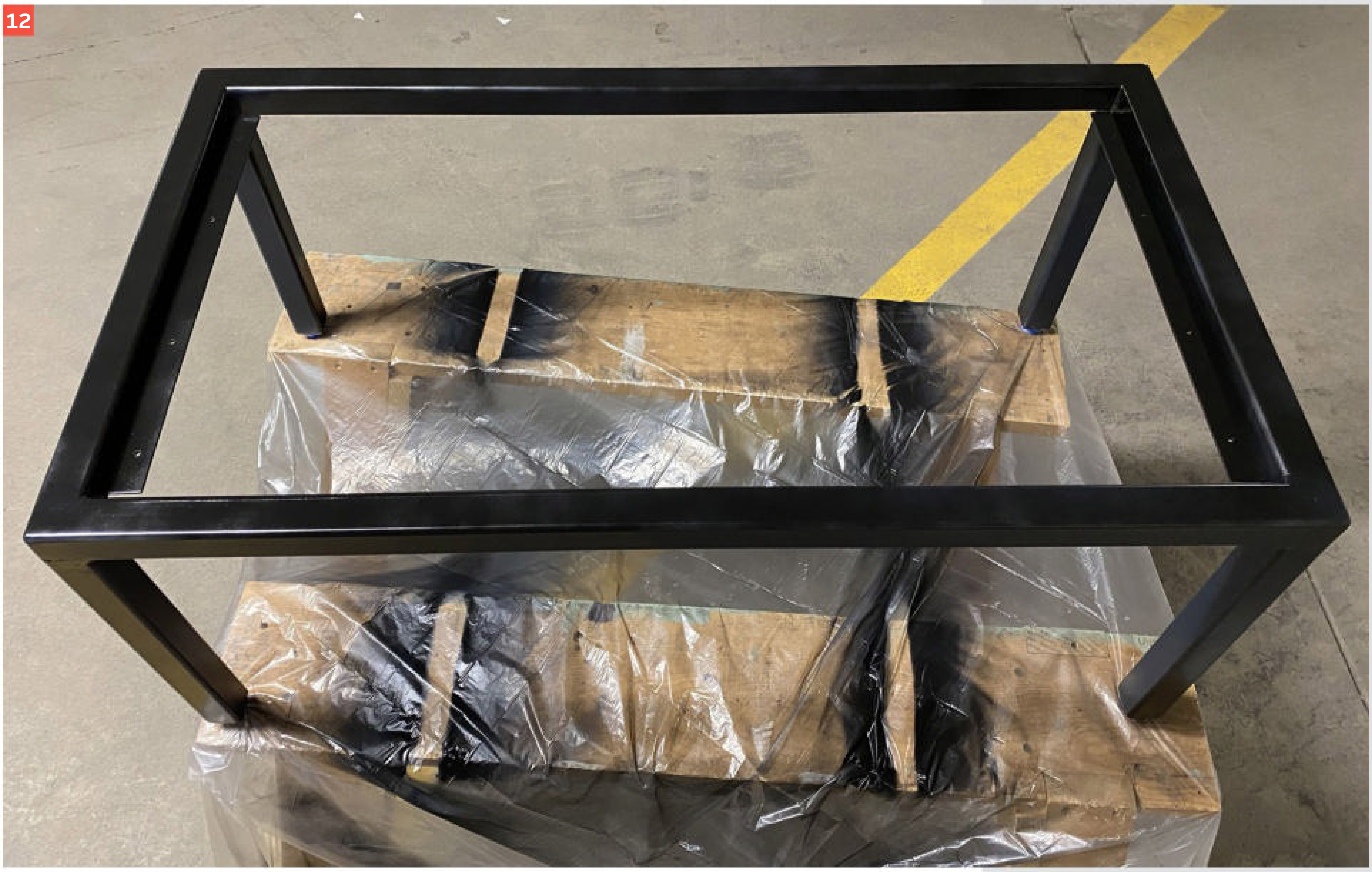

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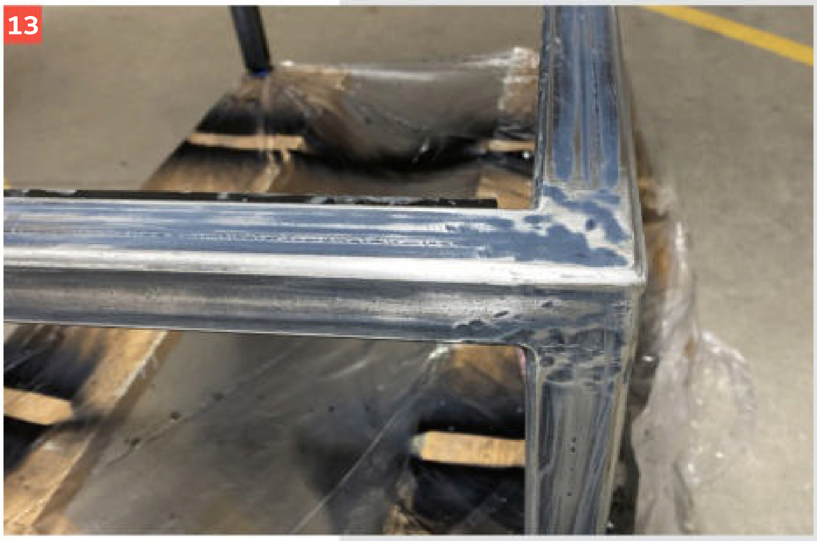


PAINT AND FINISH THE COFFEE TABLE

As with the tabletop, you can finish the frame however you like. You can leave it natural steel and it will oxidize over time, you can paint or clear-coat it, or you could apply a special patina finish. I used paint to create a used, distressed look. Before you apply any finish to the frame, use some sandpaper (220-grit or higher) to clean up any oxidation (rust) that might be on the metal. Then wipe the frame down with denatured alcohol to remove any oils that could prevent the paint or finish from sticking to the metal.

- To finish the coffee table frame, remove the top. Apply finish to the bottom first—you won't see it, so it doesn't need to be perfect. I sprayed a very light coat of flat chalkboard paint first, followed by a light coat of flat black.
- Flip the table frame over and apply your finish more carefully. I ended up spraying two light coats here as well [12].
- After the paint dried, I used 600-grit to wet-sand a lot of the paint off—leaving some in the lower areas the sandpaper didn't reach [13]. Wipe the surface dry as you work so that it doesn't start to rust. Once you've achieved the look you want, wipe everything down with a clean rag and water, then dry everything well.
- Once the frame is dry, apply a clear coat of satin or matte paint on all surfaces. This will give it a uniform luster, but also protect it from rust.
- To finish your coffee table, screw the leveling feet in the bottoms of the legs and put the tabletop back on. And there you have it. ■

BRAD FORD

4

Members Only

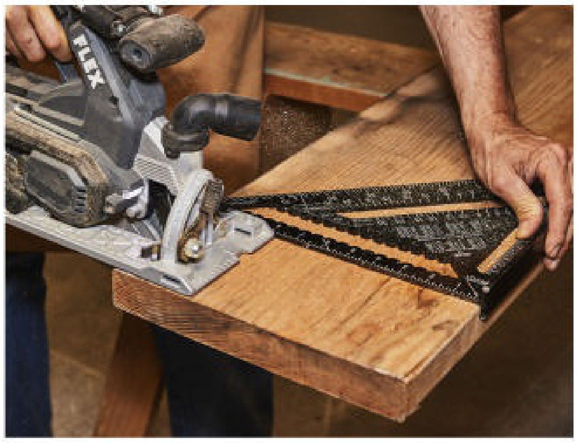
// THE LATEST NEWS AND OTHER HAPPENINGS FROM POPMECH PRO //

POPMECH PRO

It's easy to lose track of all the perks that come with your PopMech Pro membership, like exclusive features, detailed plans for DIY projects, and a weekly members-only newsletter. **Here are some of the best recent Pro stories you might have missed.** (Not a member? Head to popularmechanics.com/join.)

HOW TO USE A SPEED SQUARE

We just named the Speed Square one of our "22 Greatest Tools" (page 55). In fact, gear editor Brad Ford uses it on practically every woodworking project. In a popular how-to guide, Ford shows you everything you need to know to use the triangular carpenter's tool—including marking right angles, squaring up joints, and using it as a saw guide. Start measuring at **popularmechanics.com/speed-square.**



POPULAR MECHANICS

THE QUEST FOR MACH 2

AFTER THE CONCORDE'S DEMISE, SUPERSONIC TRAVEL GETS A SECOND CHANCE.

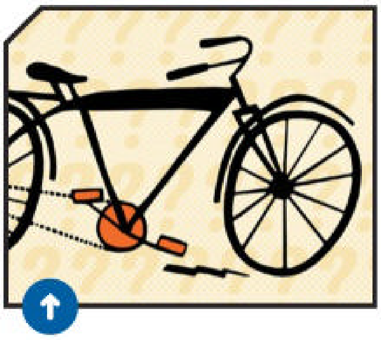
A NEW POPMECH ISSUE JUST FOR MEMBERS

There's a brand-new, exclusive digital issue of PopMech available NOW, and it's packed with original, in-depth feature stories you can't find anywhere else, exploring the most compelling corners of the universe—and beyond. (Think: America's legendary M1 Abrams tank, how to turn a classic car into an uber-efficient EV, and the final minutes of the Concorde disaster.) **To immediately unlock the issue, head here: *popularmechanics.com/digital-issues.***

THE SCIENCE BEHIND SLEEP PARALYSIS

Have you ever hallucinated that you got out of bed, only to find out later that you were still asleep? In a member-exclusive video, Stanford neuroscientist (and TikTok star) Ben Rein explains the frightening reason why: Usually, when your brain is in REM sleep, your body is paralyzed so you don't act out your dreams. But occasionally, something happens called hypnopompic hallucinations, which is a rapid shift from REM to wakefulness.

POPULAR MECHANICS

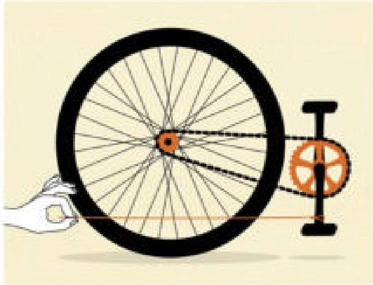


SOLVE IT:

THE BICYCLE RIDDLE

*Members loved this fun physics riddle that first appeared in the Sunday newsletter. Can you solve it? See the answer: **popularmechanics.com/bicycle-riddle.***

You have a bicycle, and your friend is holding it up so that it will not fall over, but they are not applying any pressure to it in any direction. You rotate the crank so that one of the crank arms is facing straight down, and then you tie a length of string around that crank arm. The setup will look something like this:



With your friend holding the bike up, you pull back on the string. Will the bike move forward, move backward, or stay in the same spot?

Hint: *The bike's rear wheel will not skid.*

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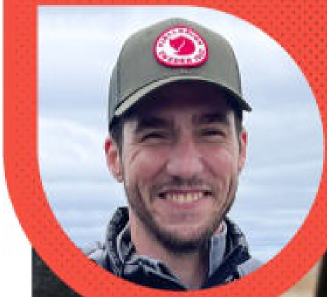
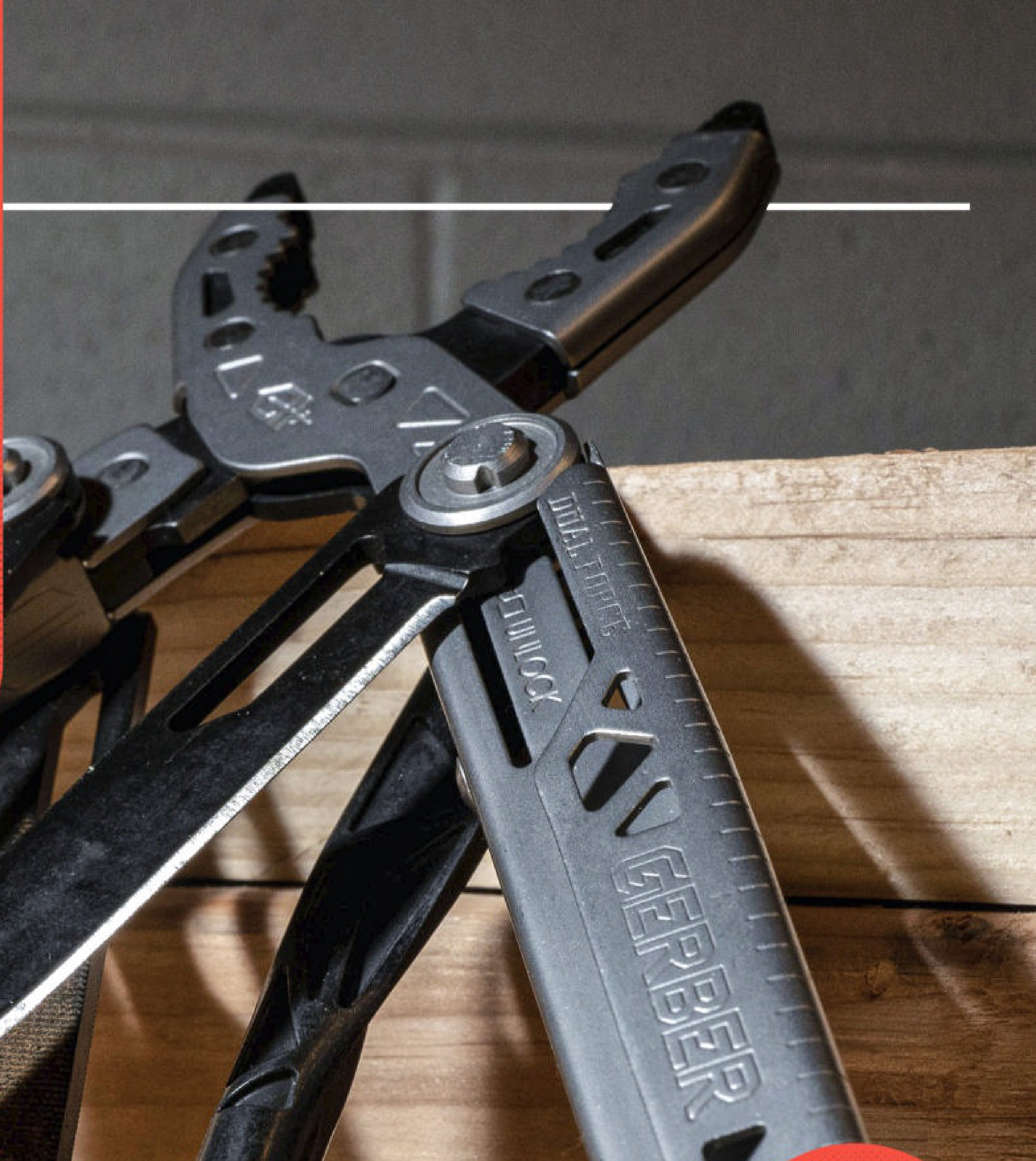
TREVOR RAAB (SQUARE); POP MECH VIDEO (SLEEP); MICHAEL STILLWELL (PUZZLES); ASSOCIATED PRESS (COVER)

A+ Engineering

The pliers are very well engineered. They have a hinge to adjust the jaw size, which was handy for tightening a variety of fasteners and providing a good grip for bending and manipulating metal. However, there's no pointed tip or good place to strip wire, so I wouldn't use them in place of a good wire-stripper or needle-nose pliers. *—Seth B., El Dorado, AR*





Hundreds of PopMech Pro members have signed up to field-test products—drills, wrenches, work gloves, and more—for *Popular Mechanics*. Recently, we sent testers a Gerber Dual-Force to obsessively scrutinize. Between its accessible outside frame and the biggest pair of pliers we've seen on a multitool, members said the Dual-Force ($110) will save you from extra trips back to the shop.

BECOME A PRODUCT TESTER! → Join PopMech Pro for the chance to try cool new tools and see your feedback appear on this page. We're looking for testers from all backgrounds and skill levels. **Apply now at *popularmechanics.com/become-a-field-tester.***

Points for Portability

The Dual-Force is a constant cup-holder companion in my truck or boat—it's essentially a mini toolbox. The accessibility, locking mechanics, and comfort were all top-notch. It was fine to carry on my belt, but it's a bit heavy to store in my pocket. *—Doug A., Fridley, MN*

A Champion Chiseler

I was actually quite surprised how well the chisel worked. I used it to expose the head of a nail, which I had to chisel pretty deep to expose fully. The tool was sharp, and I was able to chisel off consistent layers of wood to work my way down and pull off long strips at a time, which made the job quicker.*—Frederick L., Richmond, VA*

THOMAS HENGGE (GERBER); COURTESY (HEADSHOTS)

INTRODUCING
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Can't Stop Thinking About

5

Estimating planet mass and tilt could let scientists be pickier in studying exoplanets.

GETTY IMAGES

JUPITER'S SHIFTING ORBIT WILL MAKE EARTH PARADISE (OR HELL)

→ **OH, JUPITER. IF ONLY** the gas giant shifted its orbit slightly, becoming more eccentric (meaning oval-shaped), it could transform the shape of Earth's orbit, too, causing parts of the blue planet to move closer to the sun. That, in turn, would mean less unlivable ice-covered regions and the potential for more habitable zones.

That was the focus of a recent study published in *The Astronomical Journal*. Modeling data from our solar system as we understand it today, University of California, Riverside (UCR) scientists created a theoretical system that slightly altered Jupiter's orbit.

"Many are convinced that Earth is the epitome of a habitable planet and that any change in Jupiter's orbit, being the massive planet it is, could only be bad for Earth," Pam Vervoort, a UCR Earth and planetary scientist

5

Can't Stop Thinking About

and lead author of the study, said in a news release. “We show that both assumptions are wrong.”

A slight change in Jupiter’s orbit could also have the potential to turn portions of our planet into a subfreezing hellscape. If Jupiter positioned itself closer to the sun in its new orbit, it would create extreme tilting of Earth, causing some regions to see fewer solar rays.

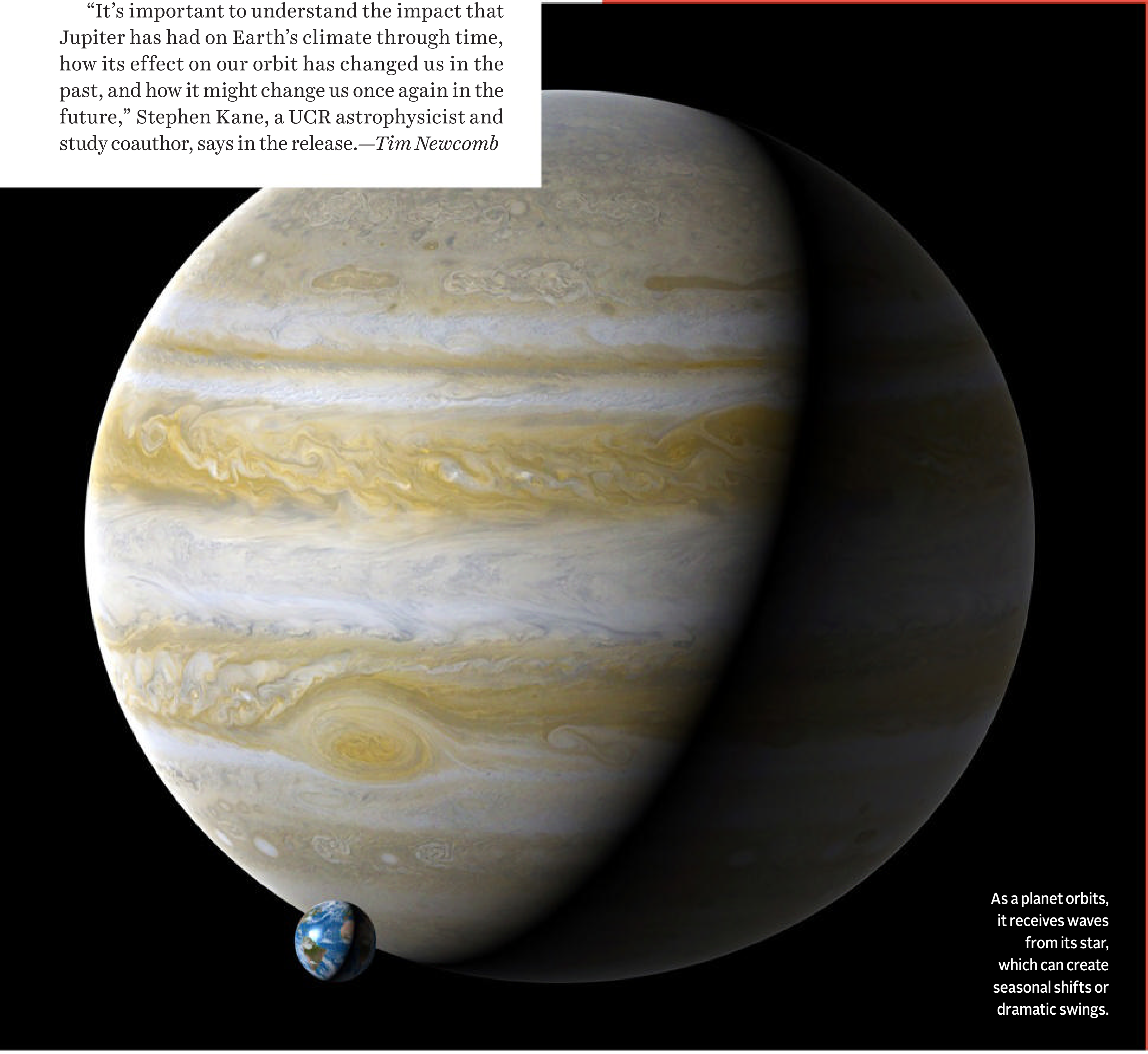
Seeing how small changes to Jupiter’s positioning and orbit lead to dramatic changes on Earth, the researchers are planning to develop methods to help them estimate factors beyond an orbit—like measuring a planet’s mass and determining tilt—to figure out the volume of rays certain areas will receive.

“It’s important to understand the impact that Jupiter has had on Earth’s climate through time, how its effect on our orbit has changed us in the past, and how it might change us once again in the future,” Stephen Kane, a UCR astrophysicist and study coauthor, says in the release.—*Tim Newcomb*

235

MILLION YEARS

Age of the youngest galaxy observed after the Big Bang (so far)—*Manasee Wagh*



As a planet orbits, it receives waves from its star, which can create seasonal shifts or dramatic swings.

GETTY IMAGES

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GETTY IMAGES

Crabs Revolutionizing the Battery Industry

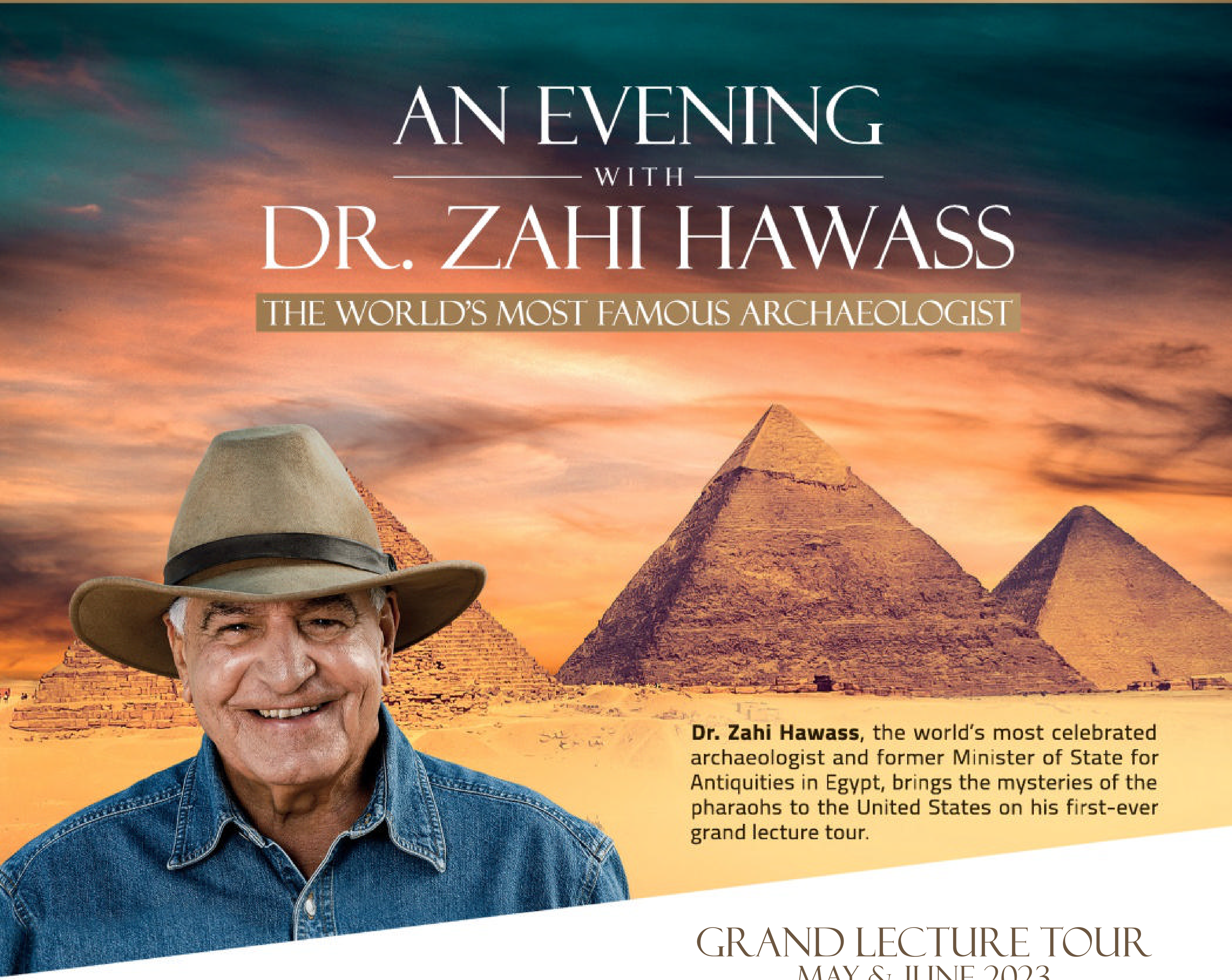
EVERY YEAR, WE PRODUCE ABOUT 6 TO 8 million tons of crab, shrimp, and lobster shell waste globally, with most of it dumped straight back into the ocean or into landfills.

The issue isn't the colossal amount of scraps, but the lost opportunity: The hardy exoskeletons of crabs and their marine ilk are rich in useful, versatile chemicals like chitin, the second-most abundant natural polymer found on Earth. Because it and its sister polymer, chitosan, are considered eco-friendly and nontoxic, scientists are interested in incorporating these chemical compounds into batteries.

In a paper published in the journal *Matter*, a group of engineers at the University of Maryland did just that, crafting a chitin-zinc battery that's biodegradable but still holds considerable juice. As the world moves toward a more sustainable future, the hope is that a rechargeable, crab-derived battery could be a viable alternative to (or a replacement for) lithium-ion batteries.

Chitin to the Rescue → For years, scientists have been toying around with chitin, which is structurally similar to cellulose in plants. In 2016, researchers at the University of British Columbia discovered that when you cook up chitin with nitrogen at temperatures as high as 1,652°F, it transforms the shells into a carbon-nitrogen

SECRETS OF ANCIENT EGYPT – NEW DISCOVERIES



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WITH
DR. ZAHI HAWASS

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material suitable for electrodes.

But scientists at the University of Maryland took a different approach, focusing on zinc-based batteries, which are a common disposable, nonrechargeable battery. Because zinc is more readily available than lithium and less toxic, scientists envision the mineral as our silvery-white energy knight.

Swapping out lithium for zinc isn't smooth sailing, though. As an electrode, zinc has an annoying tendency to form irregularities on its surface. When electrons pass through, little bumps appear that snowball into larger ones, called "dendrites," which disrupt the battery's electrical current.

Since chitosan, a chemically treated derivative of chitin, interacts well with water and is able to hold it down from floating around willy-nilly, the research team believed they could use it to make a battery separator—a semipermeable membrane that keeps the opposite-charged electrodes apart—that's also biodegradable.

Assembling the Crabby Battery → So how did they do it? First they bathed a coin-size film of chitosan in a solution filled with zinc to get the mineral to stick to the film. Next, the scientists wrung out the chitosan-zinc film and squeezed it tightly to densely pack it. Unlike prior attempts to densify chitosan films, this technique created comparatively large pores (up to five micrometers), allowing free movement of ions, says Jodie Lutkenhaus, a professor in chemical engineering at Texas A&M University, who was not involved in this study.

"This is key because when you think about a crustacean shell, you think of it being really hard and dense, and that's not good for conducting ions," says Lutkenhaus, who has done research on organic-derived batteries in the past.

To complete the build, the team placed a zinc anode atop the chitosan-zinc separator along with a cathode made of an organic compound called poly(benzoquinonyl sulphide), or PBQS. When the team ran their crab-shell battery in the lab, they saw none of that dendrite formation on the zinc anode. It generated an electrical current of 50 milliamperes per square centimeter for 400 hours (or 1,000 charging cycles), which is close to what small lithium batteries are capable of.

While you're not going to see crab-shell batteries on store shelves anytime soon, the researchers hope these may become commonplace in electronic devices like your cellphone or in dedicated storage facilities that release renewable energy to the commercial grid.—*Miriam Fauzia*

These Smart Tips to Silence a Rattling Interior

A COMMON PROBLEM THAT'S REALLY ANNOYING is hitting a big bump in the road that triggers a new rattle in your vehicle. Within an hour, it can sound like your car is about to fall apart. Before disassembling your interior and making the problem worse, try some of these fixes first.

Location, Location, Location // Start by sitting in the front seat and pushing down on some of the nearby panels. Try to get them to squeak as they bend and deform. You can also give your dashboard a couple of light taps with your fist to try to find any loose areas. If they let out any noise at all, that's probably a spot for a professional to take a look at.

However, the best thing you can do is grab a buddy and let them drive while you search for sources of noise. Start in the passenger seat and work your way around the vehicle. Once you find the rattle, you can narrow down what needs to be worked on.

Tackle Simple Things // Speaking of loose cargo, a great

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BACK-BREAKING WORK REQUIRES SOME HELP

Everyone feels the hurt as you age, but CBD can help you deal with it

Life really does fly by. Before I knew it, my 60s had arrived, and with them came some new gifts from dear ol' Mother Nature—frequent knee pain, stress, low energy and sleeplessness. Now, I'm a realist about these things, I knew I wasn't going to be young and springy forever. But still, with "golden years" nearly on my doorstep, I couldn't help but feel a little cheated. That is until I found my own secret weapon. Another gift from Mother Nature.

It began a few months back when I was complaining about my aches and pains to my marathon-running granddaughter, Jen. She casually mentioned how she uses CBD rub to help with her joint pain. She said that CBD gave her more focus and clarity throughout the day and that her lingering muscle and joint discomfort no longer bothered her. She even felt comfortable signing up for back-to-back marathons two weekends in a row this year. That made even this self-proclaimed skeptic take notice.

But I still had some concerns. According to one study in the Journal of the American Medical Association, 70% of CBD products didn't contain the amount of CBD stated on their labels. And, as a consumer, that's terrifying!

If I was going to try CBD, I needed to trust the source through and through. My two-fold research process naturally led me to Zebra CBD.

First, I started calling my family and friends. Call me old fashioned but I wanted to know if there were people whom I trusted (more than anonymous testimonials) who've had success using CBD besides my granddaughter.

Secondly, I wanted cold hard facts. Diving deep into the world of CBD research and clinical studies, I came across Emily Gray M.D., a physician at the University of California at San Diego (UCSD) Medical School and medical advisor to Zebra CBD who is researching the effects of CBD. Dr. Gray wrote "early results with CBD have been promising and we have a lot of research underway now. I've had several patients using CBD with good success. It's important that you know your source of CBD and how to use it properly."

After hearing it from the doctor's mouth, I returned to my research, asking more people and was amazed by the number of close friends and family who were already on the CBD train. Apparently, I was the only one without a clue! And funny enough, a couple of friends who commented were using the same brand as my granddaughter—Zebra CBD. There was no consensus as to why they were using CBD, but the top reasons given were for muscle & joint discomfort, mood support, sleep support, stress and headaches, as well as supporting overall health & wellness.

Eventually, even the most skeptical of the bunch can be won over. With a trusted CBD source in mind, I decided to give it a go.

When I viewed Zebra CBD's selection online, I was impressed by its array of products, including CBD oils called tinctures, topicals, chewable tablets, mints and gummies. After reading on their website that all their products are made with organically-grown hemp, I ordered... and it arrived within 2 days!

The first product I tried was the Rub. Now this stuff was strong. Immediately after rubbing it on my knee, the soothing effects kicked in. It had that familiar menthol cooling effect, which I personally find very relieving. And the best part is, after two weeks of using it, my knee pain no longer affected my daily mobility.

The Zebra Sleep Gummies, on the other hand, had a different but equally positive effect on my body. To take it, the instructions suggest chewing thoroughly. This was simple enough, and the taste was, well, lemony. After about 15 minutes, a sense of calm came over my body. It's hard to describe exactly; it's definitely not a "high" feeling. It's more like an overall sense of relaxation—and then I fast asleep. Needless to say, I slept great and woke up refreshed. I haven't slept like that in a long time.

While it hasn't been a catch-all fix to every one of my health issues, it has eased the level and frequency of my aches. And it sure doesn't seem like a coincidence how rejuvenated I feel.

All-in-all, CBD is one of those things that you have to try for yourself. Although I was skeptical at first, I can safely say that I'm now a Zebra CBD fan and that I highly recommend their products.

Also, I managed to speak with a Zebra CBD spokesperson willing to provide an exclusive. If you order this month, you'll receive $10 off your first order by using promo code "**PM10**" at checkout. Plus, the company offers a 100% No-Hassle, Money-Back Guarantee. You can try it yourself and order Zebra CBD at ZebraCBD.com/PM or at 1-888-762-2699.

place to start is with your keys. If they're attached to a big, annoying metal carabiner, they'll jangle around like a set of wind chimes when you hit even the slightest bump.

Try out rubber key covers that mute metal-on-metal contact. They may be absolutely hideous, but they're cheap and they work. A key organizer is a much better—and more aesthetically pleasing—solution that's still relatively affordable. Keybar makes an excellent version, while Orbitkey makes a more economical alternative.

Junk in the Trunk // Are the jack, lug wrench, and spare tire properly secured? This problem can be especially noticeable if you drive an SUV, van, or hatchback, where the trunk occupies the same airspace as the cabin.

It can take a while to figure out what that diagram inside the jack compartment cover is trying to tell you to do, but it's worth looking at to make sure everything is in its place.

Cleanliness Is Silence // Automakers all have Noise, Vibration, and Harshness (NVH) departments of varying sizes that spend millions to engineer whisper-quiet interiors. Today, automakers can actually predict sources of noise using computer simulations, but they don't anticipate a whole bunch of loose crap knocking around in your car.

Take out all of your nonessential items and you'll be amazed at how much quieter the interior of your car becomes. We've found rattles that turned out to be a socket set in a steel box, other assorted tools, a loose fire extinguisher, loose change, pens, and even water bottles.

Secure Everything With Velcro // Along with being dangerous in the event of a crash, loose cargo sliding around in the back of your vehicle tends to rattle and clang against other items in the trunk. The solution? Hook-and-loop fasteners.

For example, my Michael Pro Click Through torque wrench has a slippery bottom, meaning it would bash into the sides of the trunk every time I made a turn. Not great. However, all it took was a couple strips of Velcro to keep it secured to the carpeted floor. For bonus points, I also insulated the pockets inside of the case where all of the individual parts reside.

The softer "loop" side of the Velcro is also useful for insulating rattles. I used two small strips of it to insulate the sunglasses holder in my GTI.

If All Else Fails… // Unfortunately, if none of these steps solve your issue, it's time to schedule an appointment with your local dealership or mechanic. Any business worth going to will gladly work on muffling the interior.—*Matthew Crisara*

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The price paid for Buzz Aldrin's white Apollo 11 jacket at auction.—*M.W.*

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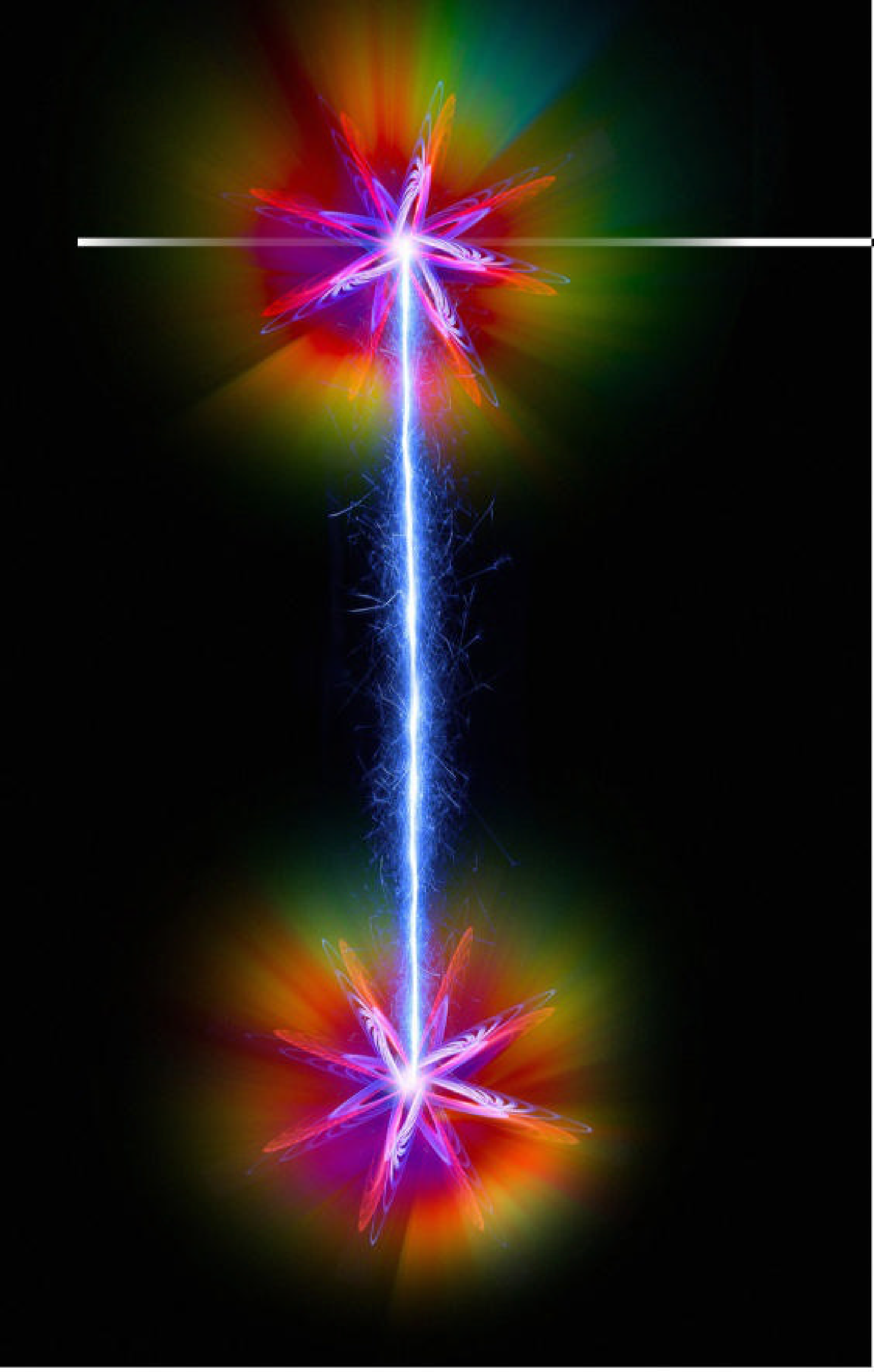

How 3 Quantum Physicists Proved Einstein Wrong

ONCE DESCRIBED AS "SPOOKY ACTION at a distance" by the world's most famous physicist, Albert Einstein, entanglement—the idea that two particles separated by vast distances could instantly influence each other—lies at the very heart of what makes quantum physics so strange and counterintuitive.

In October, the Royal Swedish Academy of Sciences awarded the 2022 Nobel Prize in Physics to three quantum physicists—Alain Aspect, John F. Clauser, and Anton Zeilinger—whose work confirmed this troubling phenomenon.

Ulf Danielsson, a professor of theoretical physics at Uppsala University in Sweden and secretary of the Nobel Committee for Physics, refers to the fact that this phenomenon of an instant quantum connection between particles across vast distances isn't accounted for in classical physics of the everyday world.

In other words, they proved Einstein wrong.

A Threat to Special Relativity → Entanglement, as it was first suggested in the 1930s, encroached on the idea of "local realism," which can be boiled down into two statements. First, realism states that all particles have definite properties for all possible measurements. Second, locality says that communication between particles can't happen faster than the speed of light.

The instantaneous action of entanglement challenged at least one of these premises, maybe both. To Einstein, via its challenge to locality, this instantaneous nature represented a threat to one of his key principles of special relativity: the fact that nothing can travel faster than light.

Einstein thought that rather than violating local realism, entanglement and its "spooky action at a distance" indicated that quantum physics was incomplete; he believed that elements connecting the variables of one particle to another would eventually be found. The elements that he and other physicists believed to be missing came to be known as "local hidden variables."

The work of Clauser, Aspect, and Zeilinger is so groundbreaking because it conclusively proved that hidden variables don't exist.

Confirming Quantum Physics Is Complete → In 1964, Northern Irish physicist John Stewart Bell devised his eponymous Bell's theorem, which suggested that locality was a testable hypothesis. Breaking local realism was referred to as "the violation of Bell inequalities."

American theoretical and experimental physicist Clauser—along with then–U.C. Berkeley graduate student Stuart Freedman, who passed away in 2012—devised the first practical experiment to hunt for such a violation in 1972. The duo built an experiment to send two entangled photons in opposite directions toward fixed polarization filters. Their results defied the rules of classical mechanics and the existence of hidden variables, and agreed with quantum theory. So, the experiment violated Bell's inequalities.

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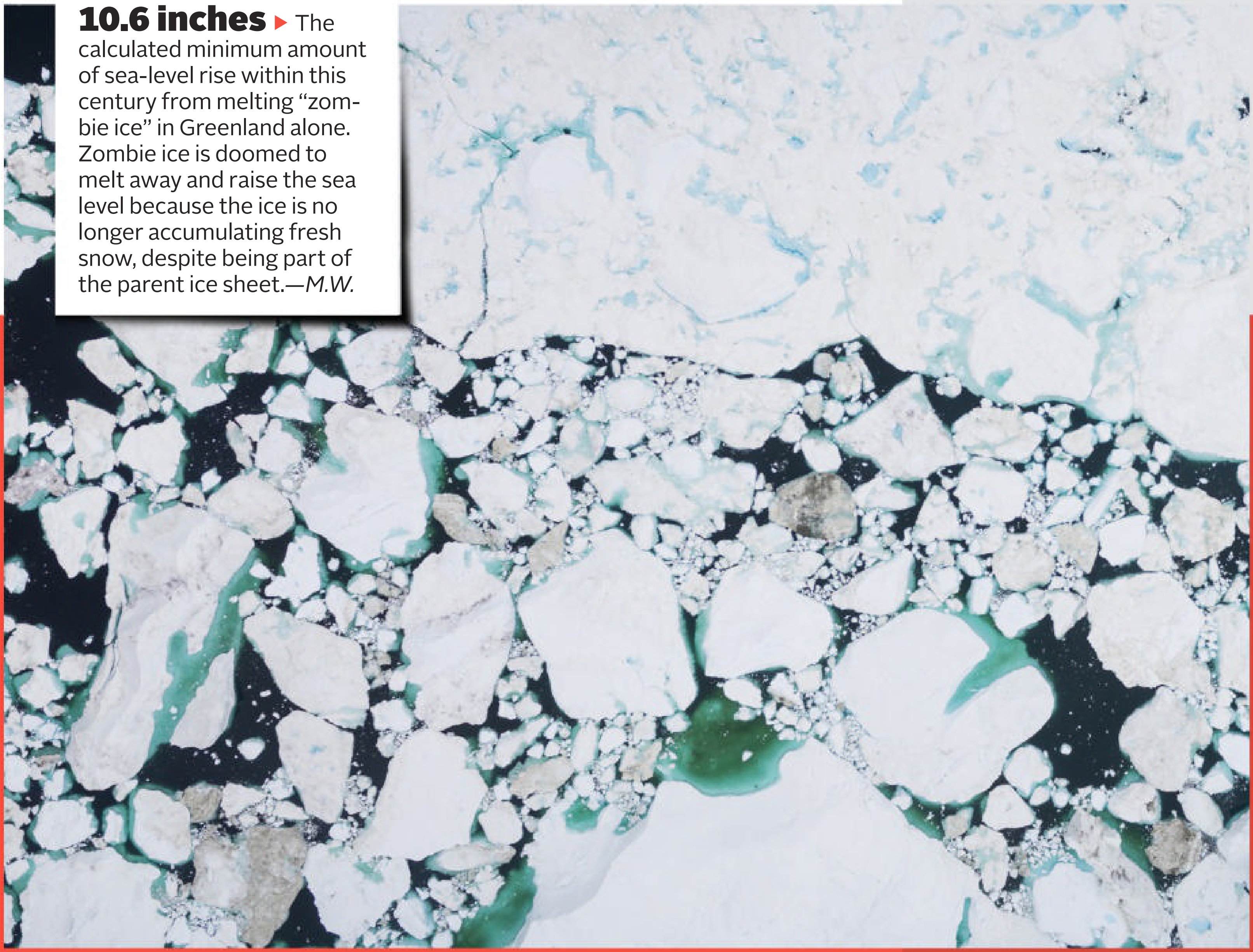
Aspect, a physicist from the Université Paris-Saclay and École Polytechnique, France, would come up with improved versions of Clauser and Freedman's experiment in 1982. Built into Aspect's tests was the ability to register photons blocked at the filter. Once again, a scientist demonstrated the violation of Bell's inequalities.

In 1997, at the University of Vienna in Austria, Zeilinger—now a senior scientist at the Institute for Quantum Optics and Quantum Information of the Austrian Academy of Sciences—went even further. He demonstrated the transference of quantum information from an entangled pair to a third particle. In 1998, he followed up this work by entangling two photons that don't directly interact by using entangled partner particles.

"Unlike Einstein hoped, there is no way that you can turn quantum theory into a physical theory that behaves locally. And the work of Clauser, Aspect, and Zeilinger was the first really convincing demonstration of this fundamental aspect of quantum mechanics," says Nicolas Brunner, an associate professor at the University of Geneva, where his area of research is the foundation of quantum theory and quantum information processing.

So what does this prize mean for the fields of quantum physics and quantum information? "I've been working with quantum non-locality for 20 years, since the beginning of my PhD," Brunner says. "To see it recognized like this by the most important physics prizes is really quite something. It's really a recognition of the importance of subjects in the field of quantum information in general."—*Robert Lea*

10.6 inches ▸ The calculated minimum amount of sea-level rise within this century from melting "zombie ice" in Greenland alone. Zombie ice is doomed to melt away and raise the sea level because the ice is no longer accumulating fresh snow, despite being part of the parent ice sheet.—*M.W.*



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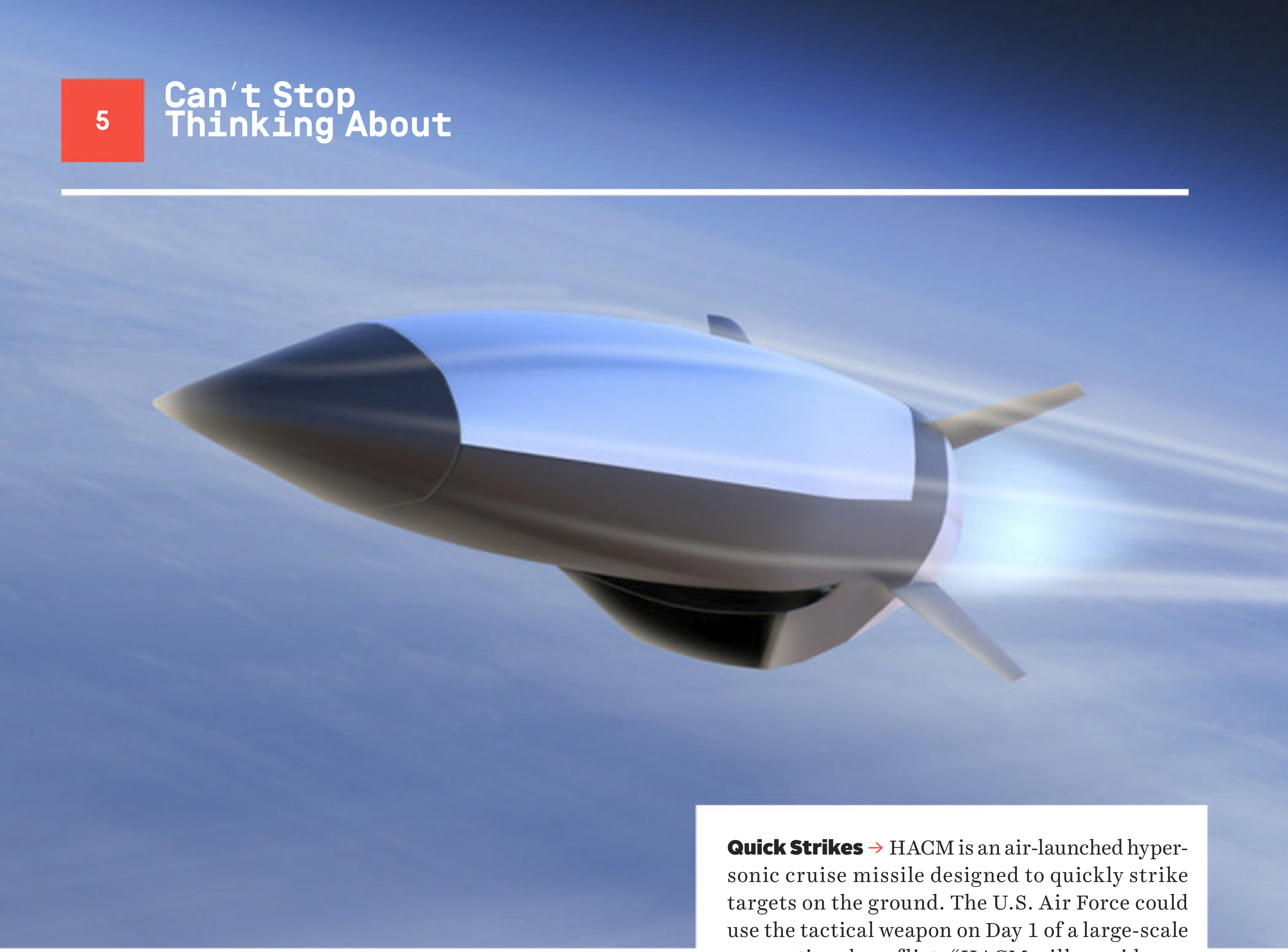

The World's First Hypersonic Cruise Missile

A NEW MISSILE SET TO ENTER SERVICE in 2027 is radically different from anything else in the Pentagon's arsenal. The new Hypersonic Attack Cruise Missile (HACM) will fly up to 20 times faster, giving adversaries little time to escape its wrath. HACM will be the first mass-produced weapon to use air-breathing scramjet engines, which scoop up oxygen from the surrounding atmosphere to use as fuel.

In September, the U.S. Department of Defense awarded Raytheon and Northrop Grumman a contract worth $985 million to develop this hypersonic cruise missile—the world's first. It builds upon the prior Southern Cross Integrated Flight Research Experiment (SCIFiRE) between the U.S. and Australia, meant to develop an air-breathing hypersonic weapon system designed for both countries' aircraft.

Quick Strikes → HACM is an air-launched hypersonic cruise missile designed to quickly strike targets on the ground. The U.S. Air Force could use the tactical weapon on Day 1 of a large-scale conventional conflict. "HACM will provide our commanders with tactical flexibility to employ fighters to hold high-value, time-sensitive targets at risk while maintaining bombers for other strategic targets," Air Force Chief of Staff Gen. CQ Brown said in an Air Force statement.

Breaking the Sound Barrier → Traditional cruise missiles are basically pilotless aircraft. Like many aircraft, turbofan engines power cruise missiles, propelling them at subsonic speeds. Cruise missiles fly low to avoid radar detection, and a slower speed helps them fly lower and hug the ground. Tomahawk cruise missiles, for example, fly at an altitude of between 98 and 164 feet at a speed of 550 miles per hour.

HACM is a hypersonic weapon, which means it will fly at Mach 5 or faster—that's five times the speed of sound—but we don't know exactly how much faster it will fly. Most missiles that remain in the atmosphere, like air-to-air missiles, top out at around Mach 3+. SCIFiRE, meanwhile, descends from the earlier HIFiRE program, which tested a scramjet engine at speeds up to Mach 8. According to NASA, scramjet engines, like those set to be used in HACM, should work at speeds of up to at least Mach 15. That translates to 11,509 miles per hour, or fast enough to circle Earth in about two hours.—*Kyle Mizokami*

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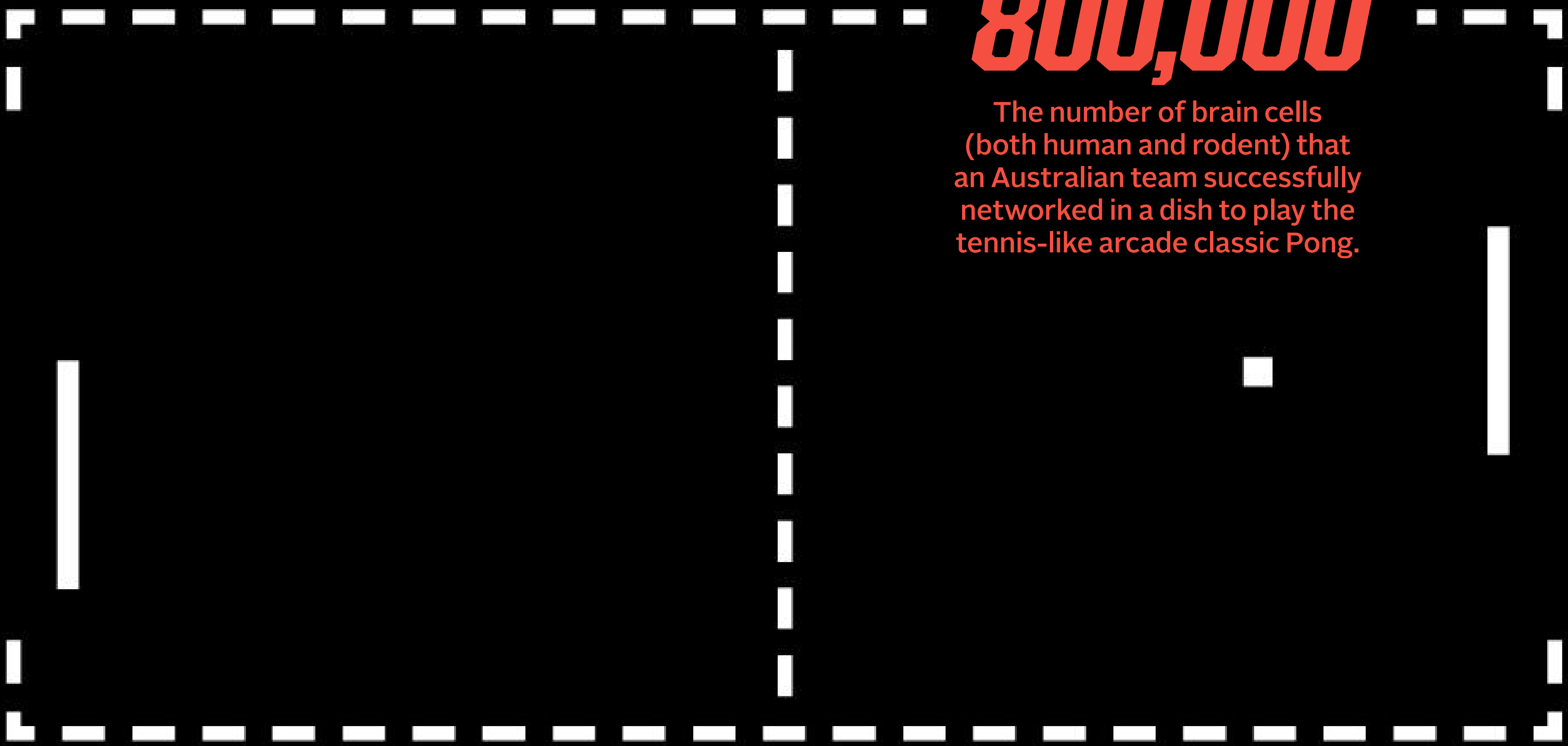

800,000

The number of brain cells (both human and rodent) that an Australian team successfully networked in a dish to play the tennis-like arcade classic Pong.

Whether Earth Once Harbored a Pre-Human Industrial Civilization

COMPLEX LIFE ON OUR PLANET HAS EXISTED for at least 400 million years. Yet as a species, we only created an industrial civilization around 300 years ago. But what if an earlier industrial civilization existed on Earth millions of years before us? Could we prove it? This is the crux of the Silurian hypothesis, a fascinating thought experiment that appeared in a study published in 2018 in the *International Journal of Astrobiology*.

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Bad to the Bone

*Full tang stainless steel blade with natural bone handle —now **ONLY** $79!*

The very best hunting knives possess a perfect balance of form and function. They're carefully constructed from fine materials, but also have that little something extra to connect the owner with nature.

If you're on the hunt for a knife that combines impeccable craftsmanship with a sense of wonder, the **$79 *Huntsman Blade*** is the trophy you're looking for.

The blade is full tang, meaning it doesn't stop at the handle but extends to the length of the grip for the ultimate in strength. The blade is made from 420 surgical steel, famed for its sharpness and its resistance to corrosion.

The handle is made from genuine natural bone, and features decorative wood spacers and a hand-carved motif of two overlapping feathers— a reminder for you to respect and connect with the natural world.

This fusion of substance and style can garner a high price tag out in the marketplace. In fact, we found full tang, stainless steel blades with bone handles in excess of $2,000. Well, that won't cut it around here. We have mastered the hunt for the best deal, and in turn pass the spoils on to our customers.

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The possibility of life elsewhere in the universe has long puzzled Adam Frank, a professor of astrophysics at the University of Rochester, New York, and one of the two study authors. "Is it common for any civilization that reaches our level of energy use to trigger their own version of climate change?" he wonders.

Did Aliens Trigger Ancient Climate Change?

→ Going back hundreds of millions of years to find traces of a potential pre–*Homo Sapiens* civilization is not simple. "After a few million years, Earth is pretty much resurfaced. You're not going to have any statues, buildings, or anything left," Frank says. Fossil records will be virtually nonexistent, as everything will have crumbled to dust. The only evidence would come in the form of chemical imprints. "You'd have to look at each layer of rock, and then try and detect trends—look for changes in things like the carbon or oxygen isotopes, which are tracers of things like carbon dioxide. An industrial civilization would dump lots of carbon dioxide into the atmosphere, just like we do," he explains. Plastic or nanoparticles found in rock layers would also be good indicators of a previous industrial civilization.

Frank and his coauthor were intrigued by the period of geological history known as the Paleocene-Eocene Thermal Maximum (PETM). That's because something truly peculiar happened to our planet during that time, 56 million years ago: Earth's average temperature soared to 15°F above today's average, and the world became a temperate and iceless place. They investigated the carbon and oxygen isotope ratios from the PETM and indeed saw spikes, but they also saw declines, all of these over a few hundred thousand years, which is nowhere near the speed at which carbon is currently suffocating the atmosphere. Frank says the PETM's chemical differences pointed to a long-term climate change.

Greater Sustainability Leads to Fewer Signs

→ There is an oxymoron in the Silurian hypothesis: The more sustainable a society is in generating energy and manufacturing, the smaller its footprint will be. Yet this smaller footprint would translate to a few markers on the geologic record for that period. For example, the more plastic we produce, the higher the chances future civilizations will find traces of us. (Our society produces 300 million tons of plastic each year worldwide—almost the weight of the entire human population.) Even if we wipe ourselves off the face of Earth with a nuclear catastrophe, long-lived radioactive particles will endure in the soil eons later.

"With the Silurian hypothesis, we articulated the kinds of signals that our civilization would leave if we disappear and somebody looks for our civilization 10 or 20 million years from now," Frank says.

It also demonstrated certain shortcomings in our current scientific apparatus. "In case an earlier species' industrial activity was particularly short-lived, we would not be able to detect it in ancient sediments with the tools and methods we have now," Frank says. "If you want to look for evidence of a previous civilization, you'd have to do studies that nobody's done and develop novel methods—for example, you'd have to figure out ways to look at the rock record on a much finer timescale."

Though Frank doesn't really believe an industrial civilization existed before our own, the main takeaway of the Silurian hypothesis, he says, is that if you're not explicitly looking for something, you might not even see it.—*Stav Dimitropoulos*

PHOTO ILLUSTRATION BY COLIN MCSHERRY USING GETTY IMAGES

12 POUNDS (OR LESS)

The weight at which a bowling ball can float in water. You can thank density for this strange phenomenon. Despite the fact that all standard bowling balls are the same size sphere, the filler inside each ball is made up of different components that affect its overall density.—*Caroline Delbert*

5th Generation Nitric Oxide Breakthrough Proven in Clinical Trials to Restore Maximum Blood Flow

Men across America are raving about a newly enhanced potency supplement that helps achieve healthy blood flow on demand

After age 40, it's common knowledge that performance begins to decline in many men. However, a new, performance empowering pill is showing that any relatively healthy man can now enjoy long-lasting, and frequent intimacy – at any age.

This doctor-designed formula, created by leading anti-aging expert Dr. Al Sears, has already helped men overcome low and sinking libido -- and has recently undergone a potency-enhancing update – with remarkable new results.

When the first pill -- **Primal Max Black** -- was first released, it quickly became a top-selling men's performance helper, promoting intimacy across America.

It worked by supporting healthy testosterone levels. However, Dr. Sears soon realized that this isn't the only challenge men face with performance. That's when he turned his attention to blood flow.

And this became **Primal Max Red**.

PROBLEM IS, RESULTS ARE MORE MECHANICAL THAN HORMONAL

Truth is, once blood flow slows down for men, no matter how exciting it is, it won't be enough without the necessary amount…

So enjoying intimacy without healthy blood flow becomes difficult for most men.

Luckily, a Nobel prize-winning scientist discovered the simple answer to help support performance strength and confidence -- by boosting vital blood flow -- and enhancing this essential performance function.

Using this landmark Nobel Prize as its basis, **Primal Max Red** enhanced healthy blood flow for untold millions of men around the world with the use of strong nitric oxide boosters.

While **Primal Max Black** helped maintain optimal testosterone, **Primal Max Red** tackles a lesser-known challenge.

Director, Al Sears MD, who has authored over 500 scientific papers and has appeared on more than 50 media outlets including ABC News, CNN, ESPN, Discovery, National Geographic, Lifetime, and many more say, *"Less than optimal blood flow can be part of a huge problem that affects a lot of men. And it needed to be addressed once and for all, so men would not dwell on it. Then, once we optimized it and had a great deal of success, we set out to see if we could do even better."*

The former formula had excellent results. However, new research showed that for even faster, anytime, anywhere results, increasing the dose of a key compound was needed.

So, one of the three nitric oxide boosters in the new **Primal Max Red**, L-Citrulline, was clinically boosted to 9000 mg, and the results were astounding. Which is no surprise considering that 5000 mg is considered a "normal amount" -- giving the new version nearly doubled the blood flow boosting power.

A new discovery that increases nitric oxide availability - resulting in even quicker, stronger, and longer-lasting performance.

Men who had previously been unsure about their power and stamina were overjoyed to be back to their old selves and to get and maintain a healthy bloodflow when they needed it.

BETTER BLOOD FLOW, STRONGER RESULTS

The best way to promote healthy blood flow throughout the body is with the use of **Primal Max Red**. By using it, when exciting signals leave the brain, blood flows much faster like it used to.

This critical action is how men across the country are enjoying full and satisfying performance at any age. No need to bother with testosterone-boosting shots, blue pills, or shady capsules that have no effect.

Primal Max Red can effectively promote healthy blood flow that most men can use for maximum intimacy. This is leading to more greater capacity and satisfaction, coupled with long-lasting performance.

"There was a time when men had little control when it came to boosting their blood flow," Dr. Sears said. "But science has come a long way in recent years. And now, with the creation of nitric oxide-boosting **Primal Max Red**, men can perform better than ever, and enjoy intimacy at any age."

Now for men across America, it's much easier to stay at their performance peak as they get older.

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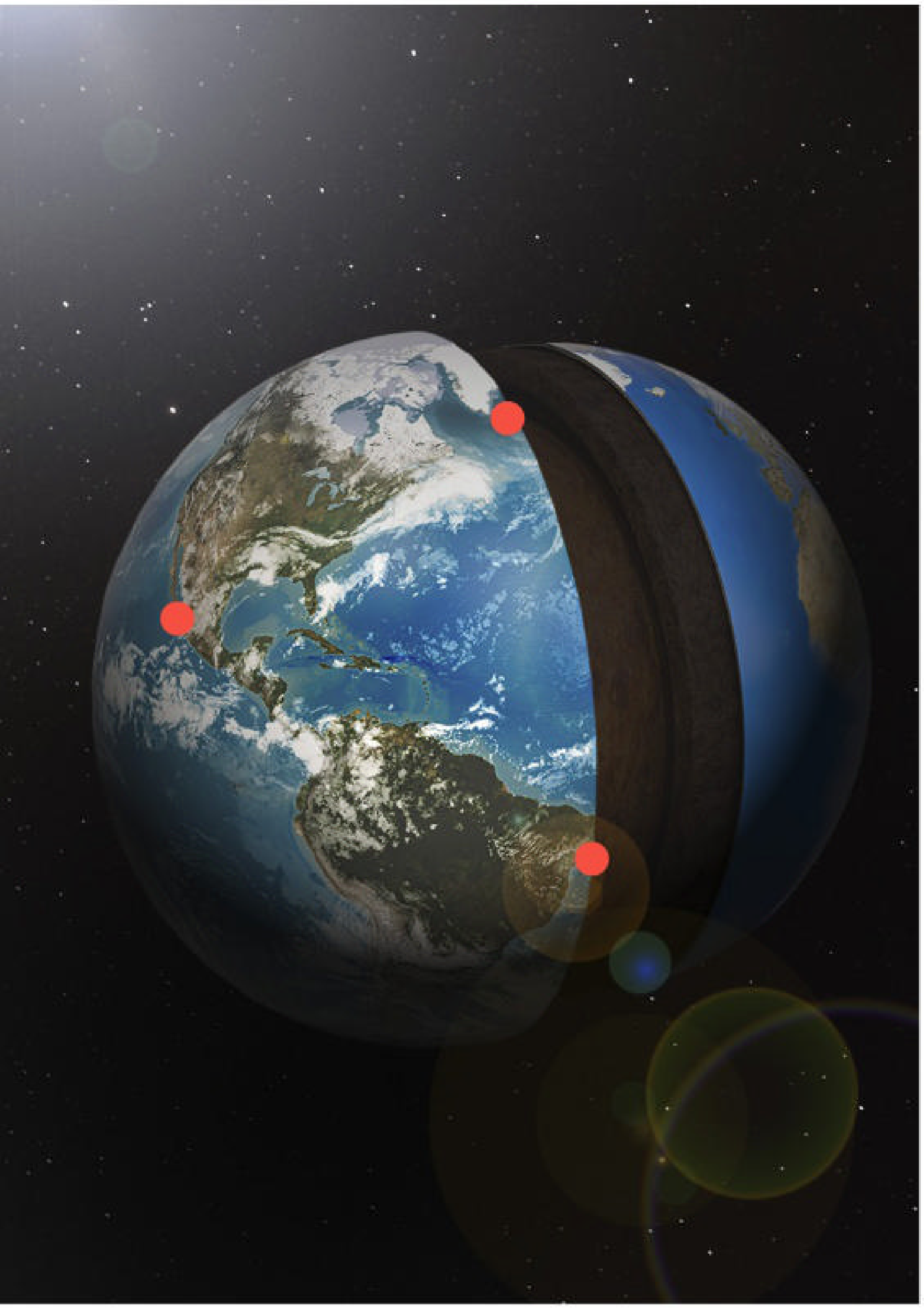
Call NOW at **1-800-377-1202** to secure your supply of **Primal Max Red** and free bottles of **Primal Max Black**. Use Promo Code **PMAXPOP1222** when you call. Lines are frequently busy, but all calls will be answered!

Solving This Maddening Probability Problem



1 / The Problem
Pick three points at random anywhere on the globe. What is the probability that all three of the points will be in the same hemisphere?

2 / The Hint
Don't know where to start? Grab your smartphone or computer and play around on Google Earth a bit to come up with a hypothesis.

3 / The Solution
There are two answers to this question, depending on whether you think about the word "hemisphere" with a capital H.

If you split Earth into its Northern and Southern Hemispheres, then we're talking about simple probabilities. There is a 1-in-2 (or 50 percent) chance that a randomly chosen location will be in one of the two hemispheres. Given three random points, that's a simple 1-in-8 (or 12.5 percent) chance. It's the same when you compare the Eastern and Western Hemispheres.

But what if one of those points is right on the Equator? Mathematically, the Equator is simply one of infinitely many Grand Circles, which we get anytime we slice a sphere perfectly in half. The center of a Grand Circle is the same point as the center of its sphere. In theory, if we sliced Earth in half at the Equator, then both of the halves would contain the Equator. So, we might as well say that points on the Equator count as being in both hemispheres at once. This follows for any possible Grand Circle.

That idea is the crux of the second answer to this question, which is 100 percent.

Imagine that two of the points you chose were on the extreme opposite sides of Earth. Create a Grand Circle that connects those two points and split the Earth perfectly in half to create two hemispheres. Let's call them Left and Right. The two points you chose count as being on both hemispheres. The third point is on either the Left or Right, which means one of those two contains all three points.

What if the third point is also on that Grand Circle? Then suddenly all three points are on both hemispheres. Still 100 percent!

To generalize, pick any three points on the globe. Choose the two points that are farthest apart and draw a Grand Circle around the globe that passes through those two points. This is always possible. The third point will naturally be on one of the two created hemispheres. *—Richard Malena*

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WHY ISN'T THE WORLD MADE *of* LEGO BLOCKS?

LEGO BRICKS ARE AMONG THE MOST DURABLE BUILDING MATERIALS IN EXISTENCE. SO WHY DON'T WE MAKE EVERYTHING OUT OF THEM?

BY **TATYANA WOODALL**
AND **JENNIFER LEMAN**

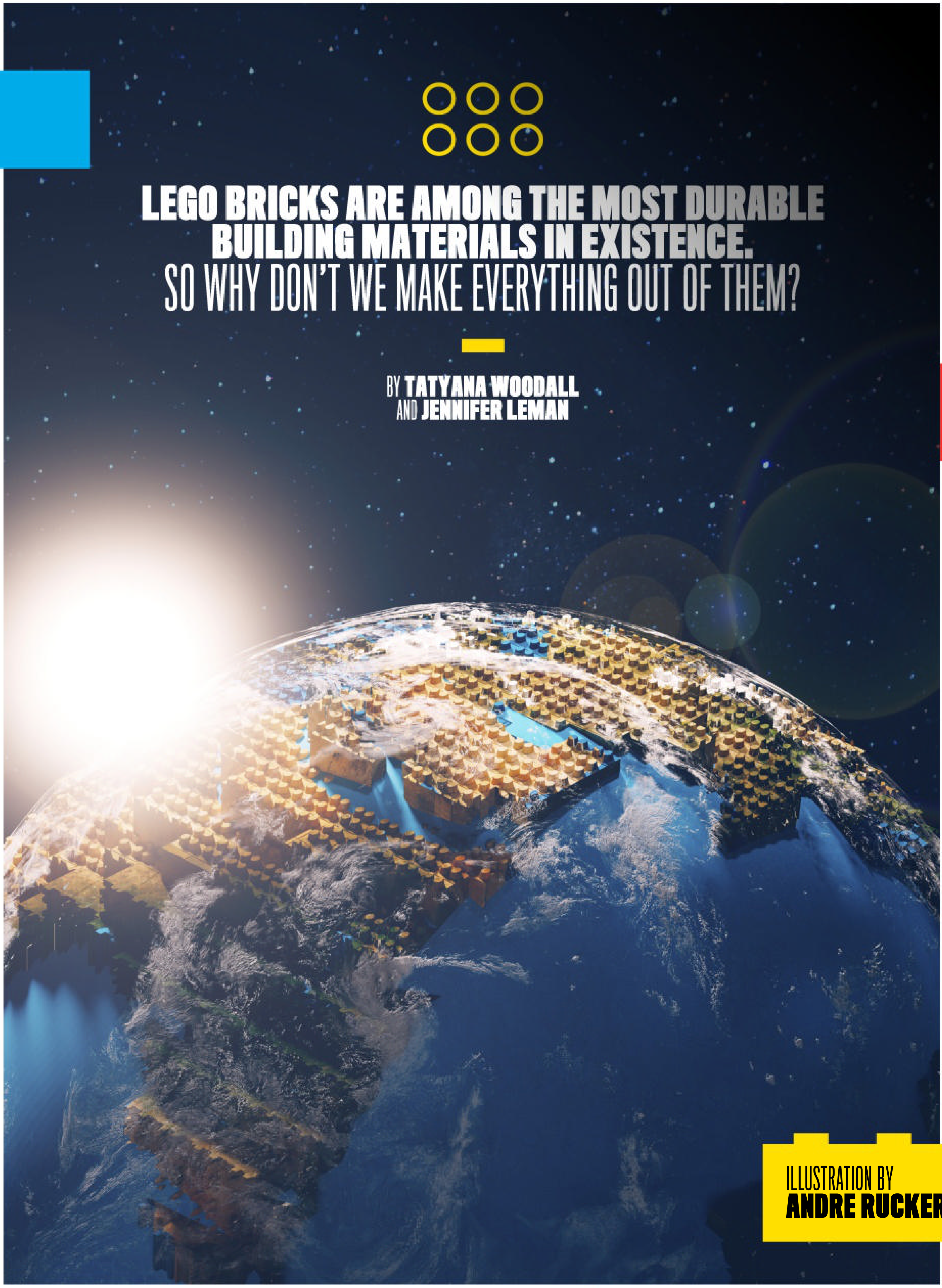


ILLUSTRATION BY
ANDRE RUCKER

IN THE SUMMER OF 2009, MORE THAN 4,000 VOLUNTEERS FLOCKED TO DORKING, ENGLAND, TO HELP FORMER *TOP GEAR* COHOST JAMES MAY REALIZE HIS CHILDHOOD DREAM OF BUILDING A REAL HOUSE OUT OF LEGO BRICKS. OVER ROUGHLY ONE MONTH, MORE THAN 3.5 MILLION PLASTIC BLOCKS WERE TRANSFORMED INTO A TWO-STORY HOME COMPLETE WITH LEGO FURNISHINGS.

Guinness World Records dubbed May's structure the largest "life-sized house made from interlocking bricks." May's house wasn't alone as a life-sized Lego build. In 2016, Land Rover built a 5.8-million-brick model of London's Tower Bridge sturdy enough to drive its SUVs across. And in 2018, an Australian team built a full-size Lego camping trailer. Such accomplishments beg the question: If we can build a Lego house or bridge or camper, why isn't more of our world made of Lego blocks?

* * *

LEGO BRICKS ARE MADE OUT OF A HARD PLASTIC CALLED acrylonitrile butadiene styrene (ABS) with a manufacturing tolerance of roughly 0.01mm. "Lego bricks are very precisely made," says Barnaby Gunning, the London-based architect who designed May's house. This precision makes them a reliable and efficient construction material.

The ABS is semi-pliable, allowing bricks to fit together using a friction-dependent connection called a snap fit. The friction between the top stud of one brick and the interior tubes of the brick atop it hold the pieces together, but not so much that they're impossible to pull apart.

Now, to look at Lego bricks as a building material, picture a Lego skyscraper and measure the brick's strength against the forces that architects and engineers design buildings, bridges, and other structures to withstand. These forces—compression, shearing, and tension—are caused by different loads to which a structure is subjected. These loads can include the weight of the building's materials, rooftop snow accumulation, gale-force winds, or the sudden shudder of an earthquake.

Lego blocks can withstand impressive compression (compacting) forces. In 2012, researchers at England's The Open University tested the strength of a 2x2-stud Lego brick using a hydraulic press. The brick held up a staggering 950 pounds of force before failing. That strength, in theory, could support about 375,000 other bricks, or a tower just over two miles high. They're also adept at resisting shear (sliding) forces; the stud-and-tube design locks the pieces in place to keep them from sliding side to side. But tensional (pulling) force is the block's structural weakness: Under tension, they begin to separate, and the structure collapses.

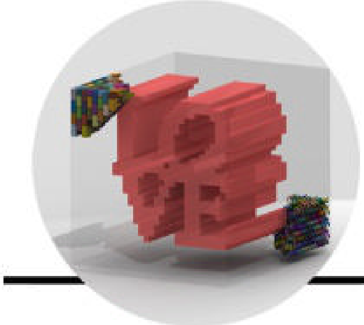
That's unfortunate news for our skyscraper of blocks fused solely by stud-tube friction. "The friction is just not enough to withstand, say, an earthquake or an extreme windstorm," says Stephen Ressler, PhD, a mechanical engineer and professor emeritus from the U.S. Military Academy at West Point.

During a hurricane, wind might push against the wall of a house and begin to lift the roof up. As the roof lifts off the structure, it creates a suction force that bends the wall and loosens the joints near the ground. In a house of Lego bricks, these forces would tear the ABS blocks apart. Similarly, in an earthquake, ground shaking might cause our high-rise to sway from side to side. As the tower bends, the blocks separate and lose the frictional force that holds them in place.

And as the height of our skyscraper increases, its stature acts like a lever to amplify tensional forces. The higher the tower, the more tensional stress the bottom joints experience when lateral load is applied to its top.

INTERLOCKING ARCHITECTURE OF ALL SIZES

From prefabricated military dwellings built in ancient Rome to Sears, Roebuck & Co.'s kit homes, modular construction has served as a quick and simple way to build the world around us. Here are three innovative examples of Lego-like architecture at a wide range of scales.



SMALL / LEGO NANOSTRUCTURES

→ In 2012, researchers at Harvard's Wyss Institute developed a revolutionary way to join minuscule pieces of genetic material. These self-assembling, nanoscopic DNA "bricks" can be programmed to build different shapes based on their function. Using this tech, scientists could one day develop nanometer-size medical devices to release drugs with precision.

MEDIUM / GABLOK

→ Gablok's interlocking, Lego-like bricks, which are made from Belgian-sourced timber and graphite polystyrene insulation, come in three sizes: 30, 60, and 90 centimeters. So far, Gablok has erected flat-pack houses—most built within a single week—in Belgium, where the company is based.

LARGE / NAKAGIN CAPSULE TOWER

→ Japanese architect Kisho Kurokawa unveiled Tokyo's 14-story Nakagin Capsule Tower in 1972. The building's 140 rectangular modules were designed to be plugged in and out of a central core. Last year, Kurokawa's firm dismantled the iconic building. Its block-like dwellings were sent to museums around the world.

WYSS INSTITUTE AT HARVARD UNIVERSITY (LEGO NANOSTRUCTURES); GABLOK; GETTY IMAGES (NAKAGIN)

A bridge made from Lego bricks would face a similar issue. While the connective joints along the top of the bridge's span experience compression as they take on a load, the joints on the bottom of the bridge experience tension, open up, and fail. Gunning's team faced this struggle when building May's Lego home. To ensure the second story would be strong enough to hold the weight of May and his film crew, the team tested different beam designs to see which one could best resist these tensional forces. (At one point, the film crew, unhappy with the slow nature of one beam's deformation, asked Gunning's team to toss bags of gravel onto the beam.) The sturdiest design, a vertical stack of bricks laid horizontally within a beam, withstood twice the amount of weight as their previous designs.

While Lego blocks can be pulled apart and snapped together in endless configurations, Gunning says that level of flexibility is difficult to replicate at the city scale. Many structures like Paris's Centre Pompidou or Kisho Kurokawa's Nakagin Capsule Tower in Tokyo, initially lauded for their flexible, modular design, are assembled and then remain in that configuration for many years because the logistics of deconstructing them is simply too difficult.

There are a number of practical concerns in large-scale Lego brick use, too. A masonry brick costs about 65 cents. To create a Lego equivalent, Gunning and his team used 272 of the standard 2x4 pieces. They estimated the street value of each 2x4 piece to be 10 cents, so it would cost about $27 to replace one concrete brick. While many bricks were donated, an estimate puts the investment in the 3.5 million-plus brick house at around $350,000. Though if the construction process is efficient enough, the contractor might be able to offset the cost of materials by saving money on time and labor, says Fred Meyer, PhD, a structural engineering professor at Georgia Institute of Technology in Atlanta.

Beyond the cost of the bricks, a Lego building still needs to fit water and drain pipes, HVAC, heating, and electrical into the blocks without compromising their integrity. "And if something goes wrong, how do you access them?" adds Meyer.

So, could swapping out plastic for another material make a tower of friction-bonded blocks stable? The concrete blocks commonly used to build retaining walls and other smaller masonry projects, for instance, may seem like an obvious substitute for plastic because the blocks'

↖ BBC presenter James May's Lego home featured 3.5 million bricks.

> ***They have this beautiful system, that if you accidentally destroy a Lego [brick], the utility of the rest of the system is still there.***

weight would help stabilize the tower. Not so, Ressler says: "It'd be really difficult to manufacture concrete components that fit together [precisely] enough to generate a really strong friction bond between the pieces."

Even if manufacturers could develop a snap-fit concrete block, it still wouldn't produce a reliable connection. If exposed to enough tension, the friction that binds the blocks together would dissolve. This is why the steel rebar in reinforced masonry is so critical. "The tensional strength of a concrete block is typically about 10 percent of the compressive strength," Meyer says. "When you put concrete and steel rebar together, you're capitalizing on the compressive strength of the masonry and the tensional strength of the steel."

* * *

DESPITE ITS IMPRACTICALITY AS A building material here on Earth, the Lego

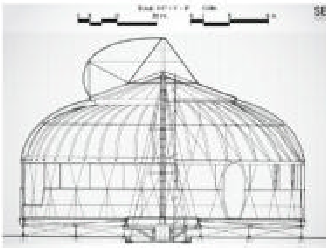
IN PURSUIT OF FLEXIBILITY:
PREFAB AND MODULAR ARCHITECTURE

Lego bricks are known for modularity, efficiency, and ease. Designers, architects, and engineers have chased the idea of flexible living for centuries.

↑ **A.D. 100–400** / Ancient Roman armies build prefabricated forts that could be constructed and deconstructed with ease and efficiency.

1849 / As many as 5,000 “packaged homes” manufactured in Boston, New York, and Philadelphia are sent west to house Northern California’s gold prospectors.

1908 / Sears, Roebuck and Co. sells its first prefabricated home. Over the next 32 years, it would sell more than 70,000 homes in 447 different variations.



↑ **1920S** / Scientist and inventor Buckminster Fuller introduces his Dymaxion House, which comes with a prefabricated bathroom module.

↑ **1933** / Robert W. McLaughlin debuts the first fully modular home, the Winslow Ames House, in New London, Connecticut.

1942 / In a clandestine project, the U.S. government commissions firm Skidmore, Owings & Merrill to erect a town of prefabricated structures in Oak Ridge, Tennessee, the site of the infamous Manhattan Project, nearly overnight.

1967 / Architect Moshe Safdie debuts his boxy Habitat 67 complex at Montreal’s 1967 Expo.

↑ **1990S** / Interloop introduces its Lego-like Klip House, which had computer-rendered modules that could be locked in place, allowing residents to expand their home to meet their growing needs.

2020 / To handle an influx of COVID-19 patients, the Chinese government erects the 1,000-bed Huoshenshan hospital in Wuhan in less than two weeks.

brick still could influence what life might look like beyond our planet. The International Space Station and similar structures are constructed using large pre-assembled modules with parts that aren’t designed to be used again once their missions are over. But to effectively and sustainably explore our solar system and beyond, some researchers at NASA believe that we need to develop building blocks that can be reused for subsequent structures—just like using Lego bricks on project after project.

NASA’s Automated Reconfigurable Mission Adaptive Digital Assembly Systems (ARMADAS) is developing tools to autonomously assemble otherworldly habitats. The materials used on the project share a lot of similarities with Lego bricks, says Kenneth (Kenny) Cheung, PhD, an ARMADAS project manager at NASA’s Ames Research Center in Mountain View, California.

“One of the wonderful lessons in Lego is the measurable precision,” Cheung says. “If you accidentally destroy a Lego [brick], the utility of the rest of the system is still there.” When one piece is lost or destroyed, the team can salvage the project by swapping in a ready-to-go replacement. Cheung’s goal is to translate that kind of adaptability to the ARMADAS project for building things like the moon-orbiting Gateway space station or infrastructure on the lunar surface. And just like Lego builds, once a structure is no longer needed, it can be broken down and rebuilt into the next configuration.

GETTY IMAGES (JAMES MAY, ANCIENT ROME); NASA (ARMADAS); ALAMY (DYMAXION); CREATIVE COMMONS (WINSLOW AMES); INTERLOOP (KLIP HOUSE)

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ETH: 01/16/22-12:57:02 - SHARE FOUND - [GPU 3]
ETH: Share accepted [94 ms]!
ETH: 01/16/22-13:03:14 - New job from eth-eu1.nanopool.org:9999
ETH - Total speed: 69.164 Mh/s, Total Shares: 6, Rejected 0, Time: 00:07
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THE UNRELENTING ROAR TORE THIS TOWN

By Wudan Yan • Photography by Juan Diego Reyes

Cryptocurrency aims to revolutionize finance, but its mines are destroying communities across America.

OF A CRYPTO MINE

APART

It was nearly midnight in late April when Lynell Morris's husband, Michael, returned home after a shift at work.

As he fumbled his keys, the motion-sensing light on their front doorstep flicked on. His eye caught a glint of gold: a .22 bullet on his doormat. It seemed odd as he and Lynell own a different-caliber firearm. Nevertheless, he brought it inside and set it on their kitchen table.

A few days later, he remembered to ask Lynell about it. Immediately, she yelped, "Politics!"

Neither Lynell nor Michael is running for office. But over the last few months, Lynell had become enmeshed in local politics after a cryptocurrency mine set up shop in their town of Murphy, North Carolina, in September 2021. "Mine" is a misnomer, as these facilities are clusters of computing units, solving complex problems to help transact and generate virtual currency, with large—and noisy—fans to cool them.

Sitting in the foothills of the Appalachian and Blue Ridge Mountains, Murphy is a lush oasis promising an uninterrupted soundtrack of nature, and attracting those who value that quiet. Within weeks of when the mine began running, angry residents started complaining about the incessant noise on Facebook and Nextdoor. They likened this new, pervasive sound to a highway, a jet engine on the runway, or a semi idling in their driveway, and said it was disrupting their sleep and eroding their sense of peace.

The Morrises are lucky. They only hear the mine from their home when there's no other noise outside. But Lynell was frustrated by her neighbors' stories and began speaking out on their behalf at bimonthly county commissioner meetings. "I take up for the underdogs," she says. Lynell has always been a leader. Before moving to Murphy three years ago with the intent to retire there, she ran a small business with her husband. And, as she puts it: "I was blessed with a mouth."

Lynell ran her mouth on April 18, at the Cherokee County (Murphy is the county seat) board of commissioners meeting. More than six months had passed since the mine began causing a disturbance, and she was fed up with the lack of transparency from her elected officials, who had yet to act upon the concerns of their citizens. Residents have three minutes to make a statement during the public comment period at these meetings. Lynell took the podium and spoke for more than 20 minutes, pressing the commissioners on why they're backing the mine and what they're planning to do to mitigate the noise.

PREVIOUS SPREAD: The south-facing view from Harshaw Road. The cryptocurrency mine is a few hundred yards to the north. **LEFT/ABOVE:** Murphy resident Lynell Morris and the bullet found on her front step.

After the bullet appeared on her doorstep, she wondered if she had said too much. “I’m a Southern girl. I don’t scare easily,” she says. “It was a threat, nevertheless.”

▸ THE SOUND OF CRYPTOCURRENCY

Follow Highway 64—or as the residents call it, the four-lane—east from town for about three miles. Turn right on Harshaw Place and left on Harshaw Road at the stop sign. Drive parallel to the highway for about half a mile, and you’ll see it on your left: large white boxes housing blue containers in a cornfield, partially surrounded by a gray wall. It looks out of place in western North Carolina, something so modern.

As you approach the mine, which is owned by the San Francisco–based firm PrimeBlock, you begin to hear the roar. During the day, its low-frequency hum—which, directly outside, may go up to 95 decibels—can make it seem like you’re next to a running motorcycle.

From the mine, roads weave like a spider’s web. Harshaw Road continues east. Back at the stop sign, Mulkey Place goes straight. The two are bisected by Club House Road, which then turns into Poor House Mountain Trail. All the streets wind with hairpin turns up into the lush hills, splitting into side streets. Many houses off Harshaw, Mulkey, and Poor House Mountain surround what used to be the 18-hole Cherokee Hills Golf and Country Club, which closed at the end of 2016 .

Sound travels in waves and tends to travel farthest in open landscapes. And low-frequency sounds, like the rumble from the crypto mine, travel farther than high-frequency sounds (think: a scream, or nails on a chalkboard) because the longer waves of a low-frequency noise cover more ground before losing energy. In Murphy, residents who can hear the indelible hum most prominently live near an unobstructed path from it. During winter, the noise gets worse without leaves on trees to help absorb the sound. But year-round, residents living up to a mile away from the mine can hear it.

In December, Lynell and fellow resident Cyndie Roberson started a private Facebook group for people to share their experiences and grievances. In a town of about 1,855 people, up to 800 families live within a mile of the mine.

Many residents have installed apps on their phone to track the sound levels. It’s so loud that Gene Johnson, whose ears were damaged during his stint in the military and who now wears hearing aids, can still hear the low rumble when the aids come out. He lives on Beaver Ridge Trail, which breaks off Harshaw immediately after you pass the mine. It’s so loud that Mike and Jennifer Lugiewicz, who lived two houses down from the mine, could watch but not hear their neighbor mow their lawn. (They have since moved to be farther from the mine.) The din can hide the sound of cars, so now Shannon Coleman helps her mom, who lives a half mile past the mine on Harshaw, retrieve the mail from her box across the street on a blind turn. Her mother, who is legally blind, can’t discern the sound of an oncoming car from the sound of the mine, and fears getting hit.

The noise, residents say, is especially terrible at night and early in the morning, when it wakes them up. Some say it’s caused them to become depressed and anxious. They’ve been showing up, as Lynell has, to county commissioners meetings bedraggled, frustrated, and angry that their elected officials have done very little to protect their health.

Patricia Callahan lives in the townhouses on Club House Road. Her unit is the closest to the mine, about a quarter mile away as the crow flies.

Callahan moved to Murphy three years ago, after completing a work-study program at the John Campbell Folk School, an artisan school for adults just outside Murphy, in Brasstown. Her youngest had just left for college, and Callahan was looking for a spot where she could retire. She was taken by Murphy’s art scene, but more importantly, the tranquility, and decided to buy in Murphy. After her real estate agent showed her the townhouse, Callahan sat outside at its picnic table and thought, “I have found my peace and quiet.”

Those qualities were crucial for Callahan. A car accident 15 years ago left her with a brain injury, post-traumatic stress disorder, and depression. "I arranged my life to keep my stress low," she said. "My whole body will go into a hypervigilant fight-or-flight mode when I'm around too much noise."

When the mine came online last fall, Callahan's way of life was upended. She used to open the windows at night to cool her bedroom (she prefers not to use air conditioning because she lives on a strict budget), but she must close her windows now to lower the noise. Even that, along with wearing noise-canceling headphones, is not enough. The only time she's been able to get a good night's sleep is when she's in a hotel or camping.

The noise is a constant, Callahan says. "It's more than just my hearing. It affects my whole body, triggering PTSD symptoms," she says. Many older residents with underlying health issues who have retired in Murphy express a similar sentiment: The noise and sleep interruptions caused by the mine are making their conditions worse.

Callahan says she can't sell her house to move somewhere quieter. "Nothing is within my budget," she says. "I'm trapped here."

▸ MINING NEW MONEY

Cryptocurrency is a digital form of currency that can be used like cash or a credit card. Unlike the U.S. dollar, there is no central authority that prints more coins, or maintains the value of a cryptocurrency. This lack of oversight and regulation is appealing to many who wish to grow their wealth without traditional banking institutions.

Bitcoin became the first viable cryptocurrency in 2009, and over the last 13 years, demand for cryptocurrencies has only skyrocketed. Now, there are more than 10,000 cryptocurrencies valued around $1 trillion in total, and a 2021 Pew Research study found that one in six Americans use them. "There is a general movement of making finance more for the people," Matteo Benneton, PhD, an assistant professor of finance at University of California, Berkeley, says of cryptocurrency's appeal.

Cryptocurrency mining is computers solving complex algorithms to record crypto transactions that prevent people from spending their currency more than once. After a certain amount of work, a mine is paid in newly created cryptocurrency. This computing relies on an astronomical amount of power. The Murphy mine, according to Scott Wade, the head of operations at Exponential Digital, the company that operates the mine and was acquired by PrimeBlock last January, uses anywhere from 5 to 15 megawatts annually, enough to power up to 13,500 homes. (A gaming laptop, by comparison, would use 0.02 megawatts running year-round.)

Up until 2021, most of the world's crypto mines

The PrimeBlock cryptocurrency mine on October 14, 2022. A section of the partial enclosure can be seen in the background.

“For me, it’s more than just my hearing. It affects my whole body,” says Patricia Callahan.

THIS PAGE: Murphy resident Gene Johnson says he can still hear the mine with his hearing aids out. **OPPOSITE:** Downtown Murphy, North Carolina.

were housed in China. But when the country banned the use and mining of cryptocurrency that fall—largely because of the Chinese government's fear that cryptocurrencies are a gateway to financial crime and have a negative impact on the environment—miners flocked to the U.S. According to the Bitcoin Mining Map developed by the University of Cambridge in the U.K., the U.S. now makes up the majority of the total global hashrate, or the computational power processing cryptocurrency transactions.

In the U.S., crypto companies generally set up shop in places like the Finger Lakes region in upstate New York, eastern Washington, South Dakota, and towns like Murphy along the Tennessee Valley. They all offer cheap electricity, and often, mines can be built in repurposed factories.

Not only is noise pollution an issue, but the annual electricity use worldwide from exclusively mining Bitcoin—just one type of cryptocurrency—is extensive. Some studies estimate it can even exceed that of entire countries. This overall higher community electricity use raises the cost for residents.

THE PAIN OF NOISE POLLUTION

Because cryptocurrency is relatively new, there are few peer-reviewed studies that specifically link it to how its mines affect human health and the environment. Twenty-two state legislators have written to the EPA to monitor the environmental impact of mining cryptocurrency. But noise is the primary complaint in Murphy, and plenty is known about how loud, persistent, low-frequency sounds can lead to a host of problems.

In the 1970s, the U.S. Environmental Protection Agency's Office of Noise Abatement and Control recognized noise as a pollutant and began taking steps to limit community exposure. Through the now-defunct office, researchers determined that, to ensure their health and welfare, residents shouldn't be exposed to more than an average of 55 decibels over the course of a day. Anything higher, in terms of sound level or length of exposure, could increase an individual's chances of hearing loss.

Even though the world around us has gotten noisier since then—particularly in cities and largely due to industrial noise—our ears can't adapt accordingly, says Deanna Meinke, PhD, an audiologist who studies dangerous decibels at the University of Northern Colorado in Greeley.

Over the last few decades, researchers have seen that prolonged exposure to noise can lead to high blood pressure and other cardiovascular issues, and even exacerbate mental health disorders. What's more, noise pollution can be more detrimental at night, when our bodies are much more vulnerable to sounds during sleep.

And sound-level guidelines for health impacts beyond hearing loss don't yet exist. "We don't have limits for a noise level that would prevent heart attacks, or prevent high blood pressure, or prevent depression," says Rick Neitzel, PhD, a noise pollution expert at the University of Michigan.

In 2020, an international team of researchers published a study in *European Heart Journal* where they followed about 500 healthy adults for five years. They found that every five-decibel increase over a baseline 45 decibels for a 24-hour span was associated with a 34 percent jump in heart attacks, strokes, and other cardiovascular issues.

And in the early 1990s, the Federal Aviation Administration (FAA) sponsored several studies to determine how loud an airport could be without making residents seriously annoyed. They found that about half of the residents reached that threshold of annoyance when exposed to an average of 75 decibels over a 24-hour period, although they didn't characterize how that manifested in health impacts. But about 20 years later, a group of German researchers tracked over 2,300 residents who lived in the flight path of Frankfurt Airport, and found that the individuals who reported to be "strongly annoyed" by the noise were twice as likely as others to feel depressed or anxious.

The annoyance and resulting stress that Callahan and her neighbors face shouldn't be discounted, says Neitzel. "Annoyance is a huge byproduct of noise exposure, and we don't really understand how important that is in terms of putting someone at risk."

When noise becomes a stressor—as it has been in Murphy—it activates the adrenal system, which not only responds to stress but also regulates an individual's immune and cardiovascular system. "It's not good to spend 8, 10, or 12 hours a day in that condition," Neitzel says. It can drive up heart rate and blood pressure, and cause problems down the line.

▸ ENVIRONMENTAL EXODUS

As soon as the mine came online, residents in the surrounding neighborhood began noticing changes in animal behavior. Ronny and Kathy Williams, who live atop Poor House Mountain Trail, lament the decline of birds in their backyard, where they keep multiple feeders. "We've seen very few goldfinches this year. The house finches came and went. And I've only seen one Carolina wren this year," Ronny says.

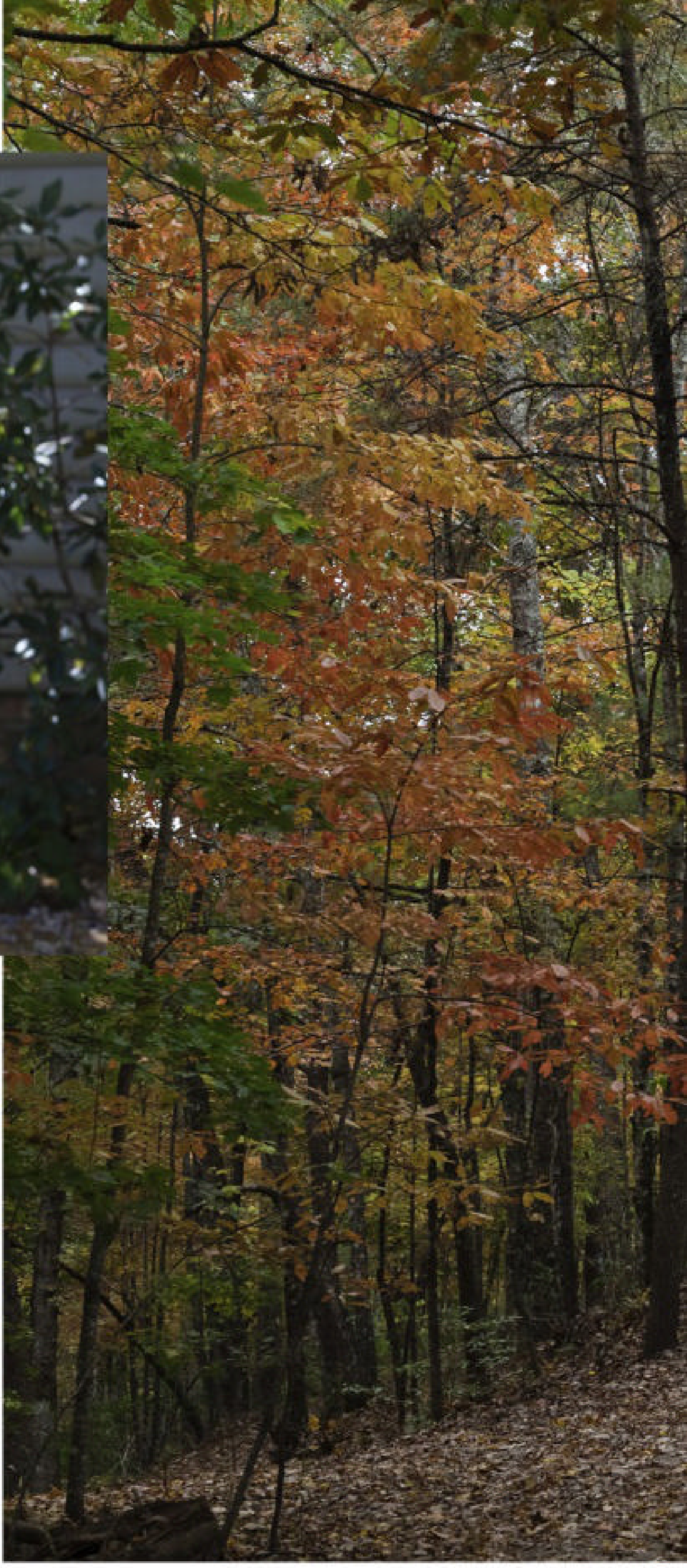
Meanwhile, Phyllis Cantrell, who lives about as far from the mine as the Williamses, has noted that hawks and eagles no longer nest nearby. The hummingbird feeders on her deck she used to refill four times a day are now going three days before she replenishes them.

The area near the mine used to be prime habitat for wild turkey and deer. Now, they're moving farther up the mountains. Morris, for instance, has recently found deer in her backyard for the first time.

A herd of horses that live on a patch of land across from the mine on Harshaw have been trying to flee more frequently, too, according to the Lugiewiczes, who live across from where they're kept. On a warm weekend last December, on a day when the fans from the mine were especially loud, Jennifer and Shannon Coleman spent an hour trying to wrangle the horses—who seemed spooked by the noise—all the while shouting over the din, standing just five feet away from each other. And dogs begin howling, says Cantrell, when the mine is especially loud at night.

Research shows that

> Researchers have seen that prolonged exposure to noise can lead to high blood pressure and other cardiovascular issues, and exacerbate mental health disorders.



LEFT: Patricia Callahan lives about a quarter mile from the cryptocurrency mine. She says its noise triggers her PTSD symptoms. **RIGHT:** Beaver Ridge Trail loops around the neighborhood next to the mine.

hundreds of animal species are affected by noise, says Clinton D. Francis, PhD, an evolutionary ecologist who studies noise pollution at California Polytechnic State University, San Luis Obispo.

The ability to perceive sounds and respond is a part of a "universal threat detection system" across vertebrates, he says. "Hearing is used to passively listen for threats while we're doing other things."

The impact of noise pollution is perhaps best characterized for birds. They may modify their songs to be at a higher pitch or sing more frequently to stand out amid the noise. Some field research shows that about a third of birds may completely leave an area because of noise pollution, with major ecological consequences. In 2012, Francis and his colleagues published a study that showed low-frequency industrial noise from gas wells and compressors (clocking in at around 95 decibels) reshaped areas of the Rattlesnake Canyon Habitat Management Area in northwestern New Mexico. Birds there are critical in dispersing seeds of the Colorado pinyon pine. And now, some preliminary research from Francis's group suggests that noise pollution may lead to inheritable changes in specific species and populations. In other words: Noisy enterprises like crypto mines can alter the wildlife near it for generations to come.

But Francis is heartened by the fact that when the source of noise is removed, animals reclaim where they once lived. Think back to the early days of the COVID-19 pandemic, for instance, when the songs of the white-crowned sparrows in San Francisco grew more frequent when the din of the city subsided, or lions napped along traffic-free roads in South Africa.

LAX ZONING LAWS AND FEW ANSWERS

Despite the annoyance, the deleterious health effects, and the damage to the ecosystem, there's no legal protection for the residents of Murphy due to scant zoning laws in Cherokee County, which would otherwise protect residential areas from industrial development. Already, there are three mines in the county, and citizens fear more may be coming.

Some Murphy residents have left because of the noise from the mine. Others who have put their life savings into their idyllic mountain home have no choice but to fight for change and show up to the commissioners meetings in droves. So far, the residents' concerns about noise mostly have fallen on deaf ears. They're also frustrated by the lack of answers from their five commissioners as to how the mine ended up there in the first place.

They're trying to get their elected officials to enforce a 1999 county ordinance under which perpetrators are fined $50 a day for sustained noise above 50 decibels. But the commissioners say that the ordinance is unenforceable without the zoning

laws that Cherokee County lacks.

And without zoning laws, it's impossible for anyone to find a legal standing to hold anyone accountable. In Limestone, Tennessee, where the cryptocurrency company Red Dog set up shop, residents had recourse because Red Dog violated an existing zoning ordinance. That county sued and won. The mine is set to shut down by the end of 2024, pay associated penalties, and relocate away from a residential area.

The Cherokee County board of commissioners—particularly Dan Eichenbaum, Gary Westmoreland, and Randy Phillips, who locals refer to as "the triad" for their similar voting patterns on controversial issues—are not keen on changing the status quo. None responded to comment on this story. And amid the calls for zoning reform, a quieter contingent of Murphy residents don't want any government interference in land use or rights.

Since the Murphy mine was set up last fall, it was partially enclosed by wall sections in February, but locals say that only made the sound worse, as the openings between the walls funnel sound in very specific directions. Wade, of Exponential Digital, said that this partial enclosure helps them "maintain and preserve natural cooling and airflow, resulting in a more energy-efficient operation while further mitigating sound." Moving forward, Wade says, the company will work closely with the commissioners to ensure the facility doesn't generate more noise.

For now, Morris hopes that this year's election will help, as the residents can vote for someone who will make decisions in their interests. "Until you get the commissioners behind this and really start pushing for it, change isn't going to happen," she says. "It starts with them."

Since the bullet on her doorstep, Morris has taken a backseat at the meetings, but she's still attending and staying engaged. Already, not even a year out, she's tired, and looking forward to what—eventually—could come after the mine. For her, it means peace and quiet, and the paradise that Murphy promised.

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BY THE EDITORS OF *POPULAR MECHANICS*
ADDITIONAL WRITING AND REPORTING BY A.C. SHILTON AND STEF SCHRADER

22 GREATEST TOOLS

IN THE HISTORY OF THE WORLD

Tools make us human, but we are not the only ones who use tools. Some birds drop rocks to crack shells open, and certain apes use sticks to get food or groom themselves. What makes us different is the thought we put into toolmaking, says Ian Tattersall, PhD, curator emeritus at the American Museum of Natural History in New York. Around 2.6 million years ago, our ancestors realized there was a superior type of rock for sharp-cutting edges (likely used to butcher animals). They chose these rocks, shaped them, and carried them for later use.

"If our predecessors had never started making stone tools, we would not be the reasoning creatures that we are today. The invention of the cutting tool opened a whole world of possibilities," says Tattersall.

The lever, however, might be the most important tool to advance civilization beyond meeting our basic needs of clothing and food, says Voula Saridakis, PhD, curator for the collections and archives at the Museum of Science and Industry in Chicago. "So many tools depend on the principals of the lever." Wrenches, pliers, hammers, shovels, and jacks all helped build our world by harnessing the mechanical advantage of leverage.

Those descendants of the first levers are among our list of greatest tools, and they're not the only ones with a mechanical lineage that dates back millennia. But all the tools here, new and old, and in no particular order, celebrate humankind's capacity to shape the world. →

PHOTO ILLUSTRATION BY COLIN MCHSERRY USING GETTY IMAGES

PHOTOGRAPHY BY TREVOR RAAB

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1. CARPENTER'S PENCIL

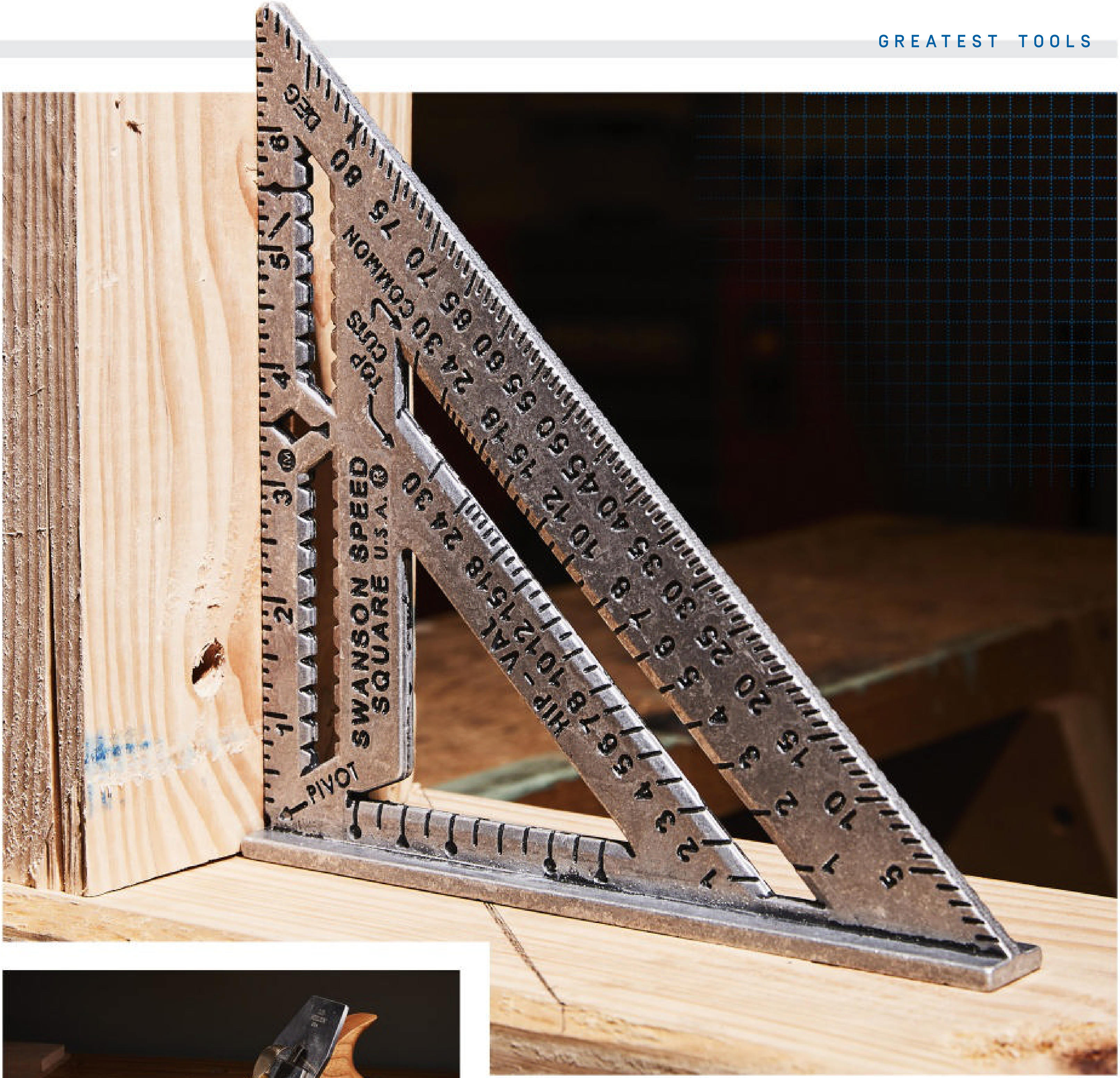
Carpenters have this amazing ability to see the unrealized potential in a tool, a piece of scrap wood, even a drywall screw. And if there's any construction-site artifact that seems to have inspired their imagination, it's the humble carpenter's pencil. Really, it's more than a all-purpose marking instrument that won't roll away. It's also a scribing tool, a spacer (the thin side is ¼ inch and the wider face is 9/16 inch), and the perfect accompaniment to a tape measure or square.

Typically, carpenters drop these wide, flat pencils—about $3 for a 10-pack, any brand will do—into their nail bag tip first so they can pluck them out and strike a quick line. To do this, put your index finger along the side of the pencil like it's an extension of your digit, instead of pinching it like you would to write with it. To scribe an uneven shape onto wood, like for lining up a cabinet on a brick wall, lay the pencil on its flat side to translate the shape of the surface (the wall) you want to match the wood to. For curves with a smaller radius or bumpy surfaces, hold the pencil down on its edge.

HOW TO SHARPEN IT

Although there are dedicated carpenter-pencil sharpeners, it's another gadget to own, lose, or break. Most carpenters use a utility knife to sharpen their pencils. This allows you more control over the shape of the tip and how much lead you want exposed.

To sharpen the pencil, start on the broad surface with the knife blade ⅝ inch to ¾ inch away from the end. With the blade square to the body of the pencil, use your thumb to push the blade forward, gradually leaning it back so that by the end of the stroke, the utility knife's blade is just about parallel with the pencil's lead. Rotate the pencil 90 degrees, and repeat the process on the adjacent edge. Repeat on the broad edge and the remaining narrow edge.



2. *Handplane*

Of all the tools you use to shape wood, the handplane has come to symbolize craftsmanship of the highest order. It's a cutting tool that's designed to create truth: dead straight and flat surfaces ready for finishing and joinery. The **Lie-Nielsen Handplane (starts at around $300)** is a longtime *PM* favorite. Sure, it's stunning to look at, but the beauty is in its flawless flat surfaces, wickedly sharp (and easy to resharpen) cutting edge, and precise adjustment capable of producing tissue-thin shavings.

3. SPEED SQUARE

The Speed Square is arguably one of the most useful building tools. Its markings help speed up repetitive procedures when framing walls or cutting rafters. The original **Swanson Speed Square Pro ($12)** comes with Swanson's Blue Book, which contains instructions and explanations of the geometry, calculation, and layout of virtually any rafter configuration. If you're only framing occasionally, it's a fantastic resource. Aside from framing, the Speed Square can be used for just about every woodworking project, including sheds, shelves, firewood racks, picnic tables, Adirondack chairs, workbenches, and sawhorses.

In addition to marking angles and parallel lines, and laying out rafter cuts, the tool's flat base makes it easy to check that studs or joints are square (as shown above). One more use: a saw guide. Hold the lip of the square against the bottom edge of the piece you're cutting and press down on the top to guide the saw for perfectly straight cuts. You can also flip it around to cut at a 45-degree angle or rotate it on the pivot point to cut at any angle.

IRWIN
VISE-GRIP

4. *Locking Pliers*

With locking pliers, suddenly you're Superman. Use them to clamp metal for welding, grab onto stripped bolts, pull nails. The original **Irwin Vise-Grip 10WR ($19)** locking plier is simple, well-built, and still great in all respects. The new model has built-in wire cutters and a recess in its adjusting knob to accept a 3⁄16-inch Allen wrench that lets you more easily and precisely adjust and release the tightening force.

5. CIRCULAR SAW

The Skil worm-gear circular saw (Skilsaw) will turn 100 in a couple years. A century is a blip in the timeline of tools, though among powered, handheld implements, it approaches an eternity. The Skilsaw makes use of a spiral steel "worm" on the end of its motor shaft, which spins a worm gear below it. The output from that gear drives the blade, reducing motor speed and increasing torque. Today's descendant, the **7¼-inch Lightweight Skilsaw ($200),** is an impressive refinement of the early models, now about half the weight (a reasonable 11 pounds 8 ounces), faster, and undoubtedly safer. And its revelatory capability—a portable saw ready to frame your next house, and the one after that—remains.

SKILSAW
SKILSAW
MAGNESIUM

6. Shovel

There are few landscaping tools as useful as a round-point shovel. It digs and moves dirt, gravel, sand, snow and ice, debris, asphalt, and concrete. It scrapes, pries, and chisels its way through roots, and is even helpful in fighting brush fires.

A shovel also makes an amazingly effective fulcrum to move the practically immovable from your lawn: Lay an open-back shovel facedown on the ground, place the tip of the digging bar under what you want to lift (such as a fence), and place the length of the digging bar into the blade crevice. You can use your foot on the digging bar to provide force. The round nose gives you the ability to rock the shovel slightly left or right as needed to aid in the lift.

A quick note: Square-nose shovels are quite agile in demolition work, where they can pry off drywall, scoop out insulation, and lift appliances for removal. But for its versatility, our desert-island shovel is this **Bully Tools 14-Gauge Round Point ($46)**.

BULLY TOOLS

BULLY TOOLS (SHOVEL)

7. Plumb Bob

The tools that literally built civilization predate records. But we can place the first level, the plumb bob, in Egypt as far back as 2700 B.C., Saridakis says. There, it guided the builders of the pyramids and other perfectly squared structures that still survive.

The Egyptians' tool looked and functioned almost exactly as it does today: a pointed weight, hanging from a string. When you suspend it, for example, from the top of a doorway, you can compare the distance from the side of the doorway at the top of the string to the distance from the side to the bottom of the weight to determine whether it is square. It can also be suspended from an A-frame to act as a horizontal level.

Its name comes from the Latin word for lead (plumbum), and it was a vital tool in the construction of the Roman Empire, says Saridakis. The tool even earned itself a Biblical metaphor in Isaiah 28:16–17, which reads that God "will make justice the line, and righteousness the plummet" in Zion.

A modern laser level from Bosch or Milwaukee is a fine addition to any tool kit today, but we still carry a plumb, like the **Empire 8 oz. Steel Plumb Bob ($7)**, as well. It's indestructible and immune to ambient light, and the battery never dies.

Picquic
Picquic
Picquic

8. Screwdriver

The screwdriver is so fundamental today that it's tough to think of any professional trade job or DIY project that doesn't require at least one. More likely, you'll need two or three, maybe more, which is why, since its introduction in 1988, we've been huge fans of the Picquic multi-bit screwdriver. The Canadian toolmaker now offers 10 versions, with the **Picquic Sixpac Plus ($15)** as its flagship. In its body, the screwdriver stores six ¼-inch bits—tough enough to use with an impact driver—while the aluminum shank with a magnetic base holds the working bit (a seventh one) firmly in place.

PICQUIC (SCREWDRIVER)

LEATHERMAN® WAVE+

9. Multitool

If there's anything a Leatherman tool is, it's an achievement of engineering. The **Leatherman Wave+ ($110)** is typical in that respect. It would be one thing if the tool packed in knife blades, pliers, and screwdrivers, and only some of them functioned. But everything works on a Leatherman. Tetris 18 tools into an 8.5-oz. package that is 4 inches long and about ¾ inch thick; if that isn't a marvel, we'd like to know what is.

10. Nailer

When a generation of new American families wanted to settle down after WWII, the early Paslode pneumatic nailer ensured they got roofs over their heads. From the 1940s to 1950s, new-home construction doubled. This feat was pulled off with new time-saving technology like the nailer and circular saw (see page 58). Instead of taking seconds to pound in a single nail, multiple nails could be fired in a second. Builders and framers gained a new level of mastery over the worksite.

Today's favored pneumatic nailer from **Paslode, the 3½-inch 30-Degree PowerMaster ($279),** is a heavy-duty nailer that doesn't sacrifice convenience. It features manual or sequential firing trigger options and is capable of sinking up to 12 nails per second. It's also designed for simple depth adjustment, so you can easily calibrate the depth of your nails. This model is also perfect for toe-nailing, thanks to a spiked nosepiece that allows you to securely bite into wood as you fire.

11. Hammer

Every trade has its hammers. Metalworking has the ball peen, masonry has stone and brick hammers, carpentry has framing hammers. Each hammer is optimized to its tasks, perfect in its own way. But there is one universal hammer everyone old enough to carry a toolbox should own: the trim hammer. Our shop has had this simple, all-steel 16 oz. **Estwing Rip trim hammer ($27)** for about a decade. The thing is indispensable and unbreakable, and will handle everything but framing—and frankly, it will handle even that for small DIY projects.

12. Utility Knife

It can cut up a box, but don't call it a box cutter. On a jobsite, it cuts shingles, roofing paper, drywall, and building paper. It can trim mason's string and scribe lines on wood—and if needed, scribe on steel and aluminum. The nearly indestructible **Stanley 99 ($7)** maintains its 1960s industrial look, but now it also has a reinforced nose to better hold the blade in place.

13. *Hydraulic Floor Jack*

The floor jack opens up a world of possibilities to the home mechanic. Beyond the oil change, it lets you quickly swap out wheels, repair brakes, or install a catalytic converter cage. It can also lift or lower components such as the suspension, exhaust, and even a differential or transmission.

The first known use of hydraulic power dates back 8,000 years to irrigation channels in Mesopotamia, though water wasn't pressurized and used as a tool until the mid-18th century, and the first hydraulic press was patented in 1795. Hydraulic jacks (lifting instead of pressing) appeared in the following decades.

Today's floor jack is a horizontal hydraulic bottle jack with a short lever on one side to lift and a long lever (handle) on the other to apply pressure. That detachable handle might be the second-most useful tool in a garage; slip it over the end of a breaker bar to dislodge especially stubborn bolts.

A good floor jack is made to be serviced, says Craig Hoffman, spokesman for Harbor Freight Tools, makers of floor jacks like the **Daytona 3 Ton Professional ($170)** used by many of our staff and writers. The chrome ram can be cleaned and relubricated, and the rollers underneath it can be greased for easier movement. And changing the oil every three years maintains the jack's power.

DAYTONA
3 TON
HEAVY DUTY

Milwaukee
CARBIDE TEETH
DIABLO

14. *Reciprocating Saw*

A reciprocating saw can cut through lumber even if it's embedded with nails. Heck, it can cut through just about everything short of a rock. It's the go-to tool for remodeling and demolition. You may also know it as a Sawzall, due to the dominance of that Milwaukee Tool recip saw. And while the category has become crowded, we still recommend, use, and try not to abuse too badly the **Milwaukee 15 Amp Super Sawzall ($199)**. It can cut all common forms of metal: steel, aluminum, copper, and cast iron. Of course, the blade you pick makes all the difference (see below).

YOUR GUIDE TO RECIP BLADES

For cutting through construction lumber, which typically has nails embedded in it, use a blade like Lenox Gold. You can also use a demolition blade, which is wider and thicker, making it better able to resist bending. If you expect to cut metal and want a single blade to handle everything, choose one with 10 teeth per inch (tpi). Although this blade will cut less aggressively, it will be easier to control. As a rule of thumb for metal cutting, use a relatively coarse blade (fewer teeth, like 18 tpi) for thick metal, such as when cutting bar stock. Use a blade with more teeth (24 tpi) for cutting thin metal and tubing.

Choose a longer blade if you want to cut wood or metal flush to a surface. The extra blade length allows you to flex the blade into a curved shape, letting you saw away the wood or metal as you run the blade against the surface from which you are removing it.

15. Oscillating Multitool

If there is one power tool that can get you out of a tough spot during a home repair or remodel, it's the oscillating multitool. It saws, grinds, sands, scrapes, and polishes. It does nearly anything you need to do, with the exception of drilling holes, and works in places other power tools can't reach, such as undercutting wood door trim to clear thin-plank flooring. And it works on a variety of materials: steel, aluminum, carpet, hard tile, soft tile, hardwood, softwood, and various plastics. The **Fein Multimaster ($200)** has gained a following over the last 25 years as tradespeople and accomplished amateurs have recognized its outsize ability and durability. It's practically our right hand in most home projects.

OUR 3 FAVORITE USES FOR AN OSCILLATING MULTITOOL

MAKE FLUSH CUTS
The offset shape of the tool's blades makes flush cuts a breeze. If a nail is poking out somewhere, remove it without disturbing the surroundings. Or when installing new flooring, cut out the bottom of trim and door jambs to make room.

REMOVE GROUT
You may want to cut out and replace the grout in a bath area just to freshen it up, or you may have a major bath remodel or repair that occurs when you replace a shower valve, for example. An oscillating tool's carbide-grit attachment can cut both grout and even the tile itself if necessary.

UPGRADE WINDOWS
You can improve the appearance and energy efficiency of old wood windows with an overhaul that includes sanding, cutting slots for weatherstripping, and removing layers of old paint. An oscillating multitool's sanding, grinding, and saw-blade attachments provide for all of these.

FLUKE
115 TRUE RMS MULTIMETER
6.000

16. Multimeter

A digital multimeter is an indispensable tool for testing, diagnosing, and troubleshooting electrical circuits, components, and devices. The first digital multimeter was introduced in the late 1970s, and has proven much more reliable than the old needle-based analog meters. It's used primarily to measure voltage (volts), current (amps), and resistance (ohms). We regularly turn to the highly accurate **Fluke 115 Digital Multimeter ($249)**, which also measures continuity, frequency, and capacitance, and can display the minimum, maximum, and average readings on its large screen.

HOW TO TEST A TOOL BATTERY

If a cordless power tool is dying faster than usual, you can check it by measuring the voltage with a multimeter: First, run the tool until the battery is nearly but not quite drained. Then recharge it and check it with the multimeter set to VDC (voltage direct current). Use the next-highest setting above the battery's voltage, such as 20 volts for a 12v or 18v battery. Press the test leads against the battery terminals. A low voltage indicates that the battery is ready to be recycled (Lowe's and Home Depot will take them) and replaced.

DEWALT
20V
BRUSHLESS
POWERSTACK

17. *Cordless Drill*

The familiar pistol-grip power-drill shape emerged from the labs of S. Duncan Black and Alonzo Decker around 1917. And WWII spurred the creation of lighter drills for the factory women that kept America running. These smaller drills became prized for home repair work and had a tendency to walk out of the factories, says Peter Liebhold, curator emeritus for the Division of Work and Industry at the Smithsonian.

Cordless models emerged in the 1960s, but they were expensive and the batteries were more useful as doorstops. By the 1980s, Makita's 7.2v cordless drill began to catch on, first with repair technicians for small jobs. By the end of the decade, remodelers, electricians, and plumbers similarly embraced the handy tool.

Today's lithium-ion-battery drills are a revolution in themselves for their power and reliability. And our favorite drill in the shop today is **DeWalt's DCD999 ($239)** for the control provided by its three-speed transmission and an 11-position clutch ring.

18. Axe

The 2.6 million years since our first stone chopping tools is an intimidating history to stand up against. It's unfair to expect that we—as multiple species over this timeline—would create the greatest tool known to any life-form. Instead, we seek a platonic ideal of the axe itself: What is today's perfect chopping tool? Our best answer is the **Council Tool Velvicut 2lb Hudson Bay ($173)**. Its carbon-steel head is sharpened and honed by hand and sits atop an American hickory handle, all balanced to help you hit your target every time.

COUNCIL TOOL CO
USA
1886

FLUKE (MULTIMETER)

19. Pipe Wrench

The wrench, one of the most obvious descendants of our prehistoric levers, largely operates on the premise that for every fastener there is a matching wrench or wrench socket waiting to rotate its flat, consistent surfaces.

Except that's not how the world works. Try to remove a stuck hex bolt with a 12-point wrench, and those six sides can become one. When it looks like you've got nothing to wrench with, a pipe wrench will save the day. (They're also unmatched on pipes, of course.)

Developed by inventor Daniel Stillson around 1869, the pipe wrench is set apart by its intentionally loose, adjustable upper jaw with hard serrated teeth. That play allows it to bind and clamp down on a pipe or stripped screw when you push the handle of the wrench down. It also spares you from having to reset the wrench when you pull up on the handle, as pulling up unbinds the jaw from your stripped nut or pipe. Just make sure you've left a space between the back of the wrench opening (the side without teeth) and the object being turned to give the jaws space to tighten down.

Since Stillson's patented design, the greatest advancement has been the aluminum wrench body, which can reduce the tool's heft by around 40 percent. That's a crucial weight savings, whether you've got the tool in your hand all day or just need to reach a single awkwardly placed pipe. **Ridgid's 12-inch aluminum straight-body pipe wrench ($60)** clocks in at a reasonable 2.5 pounds despite a heavy-duty build. It's also made entirely of replaceable—and warranty-covered—parts. It's a tool you can expect to never replace.

20. *Hand Saw*

Greek mythology offers this origin for the saw: Talos, nephew of prolific inventor Daedalus, found inspiration in a fish spine and modeled a jagged strip of iron after it to invent the first saw. Historically accurate? Not a chance. The first known metal pull-saws date back almost 7,000 years. And by the end of Talos's tale, he'd been turned into a partridge as protection from his now-jealous, murderous uncle.

The 19th century's mass production of steel gave us today's saws. For most of the last two millennia, saws were made of iron, says Ted Ingraham, director of the Zlotoff Tool Museum in South Hero, Vermont. Iron isn't a particularly hard metal. And the ensuing kinking, or twisting, of the blade was such a problem it earned the old two-person saw the name "misery whip."

Around the 1880s, a golden age of saws dawned with the wide availability of more durable and flexible steel. Two-person steel saws drove the booming American timber industry while smaller steel hand saws offered a vast improvement for woodworkers. The saws of this era were built to last—built for someone to make their living using it. Many of these steel saws remain today, but if you don't have the time and patience to hunt one down, 181-year-old toolmaker Disston is reintroducing its **D-8 hand saw** (read more on page 84).

21. Tape Measure

The earliest tools of measurement were nothing more than notches marked in a length of wood or stone, but evidence of measurement systems shows up in writings on cuneiform tablets from ancient Sumer roughly 6,000 years ago, says Saridakis. Ancient Egypt had the first known standard measure, the royal cubit (about 21 inches), based on the length of an early pharaoh's arm from elbow to middle fingertip. Inscribed wood rods—the first rulers—used to measure out the royal cubit and its fractions still survive after roughly 3,000 years.

The next great leap in handheld measuring tools didn't arrive until the 1820s with the spring-back measuring tape, though it still required a large, donut-shaped carrying case. The first truly pocket-size tape measure arrived in 1963 with the **Stanley PowerLock ($15)**. That design is so rugged and reliable that Stanley still uses it—and we're still using our PowerLocks.

HOW TO CUT DRYWALL USING A TAPE MEASURE

Place the tape's hook where you'll be making the cut. Put the tip of the utility knife blade against the hook and pinch the blade there with your thumb. Your other hand goes at the end of the drywall, pinching the appropriate-length measurement on the tape. From there you move both hands at the same time, drawing the knife and tape down the drywall with consistent downward pressure. Crack off the piece of drywall and cut the paper on the other side to release it.

22. Sewing Needle

Few tools still used the world over were so perfect at inception that they remain largely unchanged. Yet some of the early needles from around 27,000 years ago could absolutely put a button back on your flannel today. The sewing needle was also a key technology that set humans apart from Neanderthals, who never discovered or adopted the tool. Back then, sewing allowed our ancestors to build weathertight shelters from animal hides and create warmer, less-drafty clothes for our long procession around the globe. A starter pack for this auspicious tool, like the **Singer Assorted Hand Needles ($6)**, may not fit in with the rest of the implements in your toolbox, but it deserves a spot next to it. And about that button you've been meaning to reattach...

HOW TO SEW A BUTTON BACK ON

Starting at the inside of the shirt, poke the needle through the fabric and thread it through the button. Bring the needle downward and thread it through the diagonal opposite hole and the shirt. Repeat three times, then do the same on the other two holes. Once the button is secure, poke the needle up through the fabric at its base. Loop the thread around the stitching underneath the button six times. Then poke the needle through that stem sideways three times and cut to secure it.

PULP FICTION

EVERYTHING YOU NEED FOR A *killer* HOME THEATER

CUE UP A CINEMATIC EXPERIENCE THAT EVEN SPIELBERG WOULD ENVY.

★★★★★

BY **CHRIS WYLLIE**

COURTESY REDDIT U/MYWHOLENAME / INSTAGRAM @GETDOWNKID

MOVIES TRANSPORT YOU to another place or time—letting you forget external distractions and cares from your day. But if you're not up for going out to a theater, you can create that same cinematic experience in a killer home theater of your own.

Not only does a home theater immerse you in the movie-watching experience, it has some other perks as well. It can bring your family together in a dedicated space. (Get everyone off their phones for a bit!) It provides an opportunity to re-experience films you've already seen, but from a different vantage point and in a more intimate setting. And don't forget—you can also watch the big game in this same space with amazing sound and video quality. Plus, your high-tech setup for watching sports and movies will be the envy of your friends and neighbors.

★★★★★

THE EXPERT

Chris Wyllie has been designing and installing home theaters for more than 15 years through his company S.E.A.L. Solutions Inc. His projects have run the spectrum, from a living room space designed for a client's disabled child to dedicated theater rooms for celebrities, including Liam Neeson and the late James Gandolfini. A former Navy SEAL, Wyllie uses his military experience to implement a mindset of no limitations in everything he does.

Don't skimp on the sound. Invest in a surround-sound receiver and speakers for the most realistic cinema experience.

SET THE SCENE

When planning where to set up your theater, consider any unused space in your home—think basement, attic, or even a spare room. If none of these options are available, then a living room, a great room, or an area where you normally watch movies can be transformed into a more dedicated viewing space.

Note where the entrance—or the entrances, if there's more than one—is located in the room and how people move through the space. The best wall for the screen is the one that won't be in the path of people walking in and out and in front of your viewing area. That said, also pay attention to windows, which, depending on where they're located, can cast light on your screen. Lastly, if your room has any columns or wall bump-outs that cannot be moved, you'll have to design your space around them.

Taking all this into consideration will help you determine the best areas in the room for screen placement, seating, and other components.

PROJECTOR AND SCREEN OR TV?

If your space allows, I recommend a laser projector and 120-inch (diagonal) screen or larger. It gets you more screen size for your dollar than a TV, plus the benefit of new 4K laser projector technology.

Typical projectors have bulbs that slowly dim with time, and a lamp life of 1,000 to 2,000 hours. If a lightbulb in your projector pops, there's time and money involved to replace the bulb and make the fix.

Laser projectors, however, offer up to 10 times the lifespan, plus peace of mind when you press power.

Of course, a huge TV screen also provides a great foundation for a home theater. For a truly immersive experience, choose a 75-inch screen or larger.

PLEASE BE SEATED

Some installers say you can't go too big (IMAX, anyone?), but ensuring that you can see the entire screen from any seat in the room is most important.

There are ways to calculate the best viewing distance from your display to the seating area, also called the sweet spot (see "Find the Sweet Spot" on page 71). This is the optimal place in your room to enjoy both the best picture and the best sound quality—and where you'll want to arrange your seating. Don't limit yourself to a row of recliners, though. Choose comfortable pieces—a sectional sofa or loveseat—and avoid placing them too close to the screen, which can cause eye strain.

BOOM IN THE ROOM

No matter how spectacular the image, watching a movie with substandard

COURTESY KLIPSCH (ROOM); COURTESY CHRIS WYLLIE (HEADSHOT)

audio would be a major letdown.

So another important step in creating your home-theater experience is matching your big screen with big sound.

The way to achieve this is with surround sound, which will place you right in the center of the action. You'll be able to feel and hear sounds coming toward you, from behind you, and passing by you. Believe me, there's no better way to watch an action movie like *Top Gun: Maverick* or take in an audio extravaganza like *Bohemian Rhapsody*.

Traditional surround sound is 5.1 channels (five speakers plus one subwoofer), but some systems have as many as 13.2 channels, or even more.

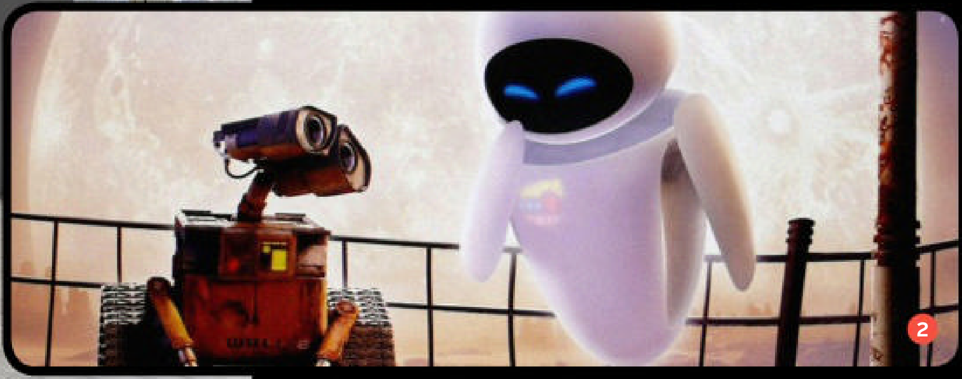
It might seem like the more speakers

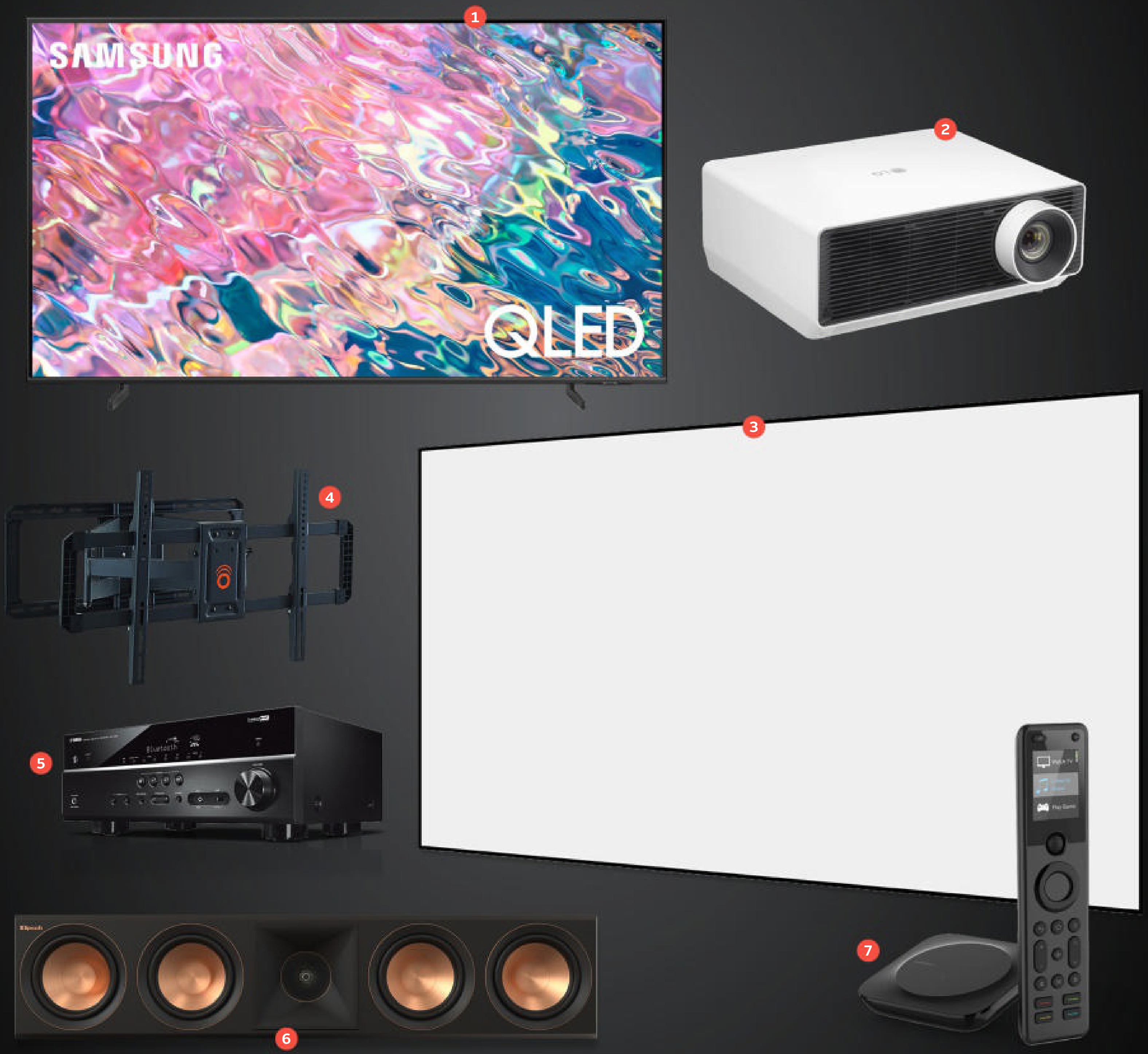
ALAMY (POSTERS)

SCREEN GEMS

Is your home theater a showcase for the best in sound and screen? Sample these cinematic marvels to hear and see if your system delivers!

1. *Saving Private Ryan* **2.** *WALL-E* **3.** *Star Trek Into Darkness* **4.** *Bohemian Rhapsody* **5.** *The Dark Knight* **6.** *American Sniper* **7.** *2001: A Space Odyssey* **8.** *Heat* **9.** *Top Gun: Maverick* **10.** *Lawrence of Arabia* **11.** *Apocalypse Now Final Cut* **12.** *300*





1 / SAMSUNG 85-INCH CLASS QLED 4K Q60B 4K TV / $1,697 Stop the show before it begins with this stunning display. Supersize, with a thin frame, it boasts a built-in processor to ensure that everything on your screen is upgraded to 4K.

2 / LG CINEBEAM 4K UHD LASER PROJECTOR GRU510N / $3,997 Get a big picture in a compact package. This projector offers amazing visibility, even when you watch during the day. No need to buy those blackout drapes!

3 / ELITE SCREENS AEON SERIES, 120-INCH CINEWHITE UHD-B / $454 This design delivers a modern look versus the velvet border of many traditional screens. The lightweight frame and screen make mounting and installation nearly effortless.

4 / ECHOGEAR FULL MOTION TV WALL MOUNT FOR 42- TO 90-INCH TVS / $120 This articulating wall mount offers almost two feet of extension off the wall with swivel and tilt ability. Gently pull the TV away from the wall and rotate it to gain access to connections on the back panel for adjustments.

5 / YAMAHA RX-V385 5.1 4K SURROUND SOUND RECEIVER / $400 If you're unable to install surround-sound speakers behind the listening position, this receiver lets you enjoy virtual five-channel surround sound with all the speakers placed in the front of the room.

6 / 7.2 SYSTEM / $4,743 With this system's dual-powered subwoofers, you'll enjoy lots of low rumble in your home theater, perfect for action flicks. When you're not watching movies, it provides an ideal listening space that puts you right in the room with your favorite musicians.

7 / SOFABATON X1 UNIVERSAL REMOTE / $190 Kiss remote-control clutter goodbye. Compatible with over 500,000 home-entertainment devices, this remote works with Alexa for voice-controlled operation and has custom activity functions. "Watch a movie" turns on your projector, receiver, and Apple TV, and changes to the correct inputs.

COURTESY SAMSUNG (TV); COURTESY LG (PROJECTOR); COURTESY ELITE SCREENS (SCREEN); COURTESY YAMAHA (RECEIVER); COURTESY KLIPSCH (SPEAKERS); COURTESY SOFABATON (REMOTE)

FIND THE SWEET SPOT

There are two formulas for figuring out the ideal viewing angle in your home theater.

According to the Society of Motion Picture and Television Engineers (SMPTE), the best view can be calculated by dividing the screen's diagonal measurement (in inches) by 0.6. For example, a screen that measures 75 inches diagonally is best viewed 125 inches from your seat. From there, no seat should have more than a 30-degree viewing angle to the center of the screen.

But THX, the company founded by filmmaker George Lucas, has a different formula, one that puts the ideal distance from the screen closer. Rather than divide the diagonal measurement by 0.6, you divide it by 0.835, which puts the ideal viewing distance from a 75-inch screen to your seat at about 90 inches.

you add, the better the sound will be, but that is not necessarily the case.

Choose the type and number of speakers based on the size of your room. If your space is small and cozy, opt for a 5.1 system. Larger rooms are better suited to 7.1 or even 9.1 systems.

Rather than purchasing individual components, a smart and cost-effective option is a home theater in a box. This is typically plug-and-play and includes everything you need: speakers, speaker wires, connectors, and surround-sound receiver with remote.

LIGHTS, ACTION…POPCORN

Lighting control is key in terms of both natural light and artificial light. To prevent sunlight from entering the room and washing out images, cover windows with blinds, drapes, or blackout fabric. To set the mood inside, use a remote dimmer, which allows you to control lighting from your seat once you've settled in and your eyes have adjusted. When the credits start rolling, use it to slowly raise the lights.

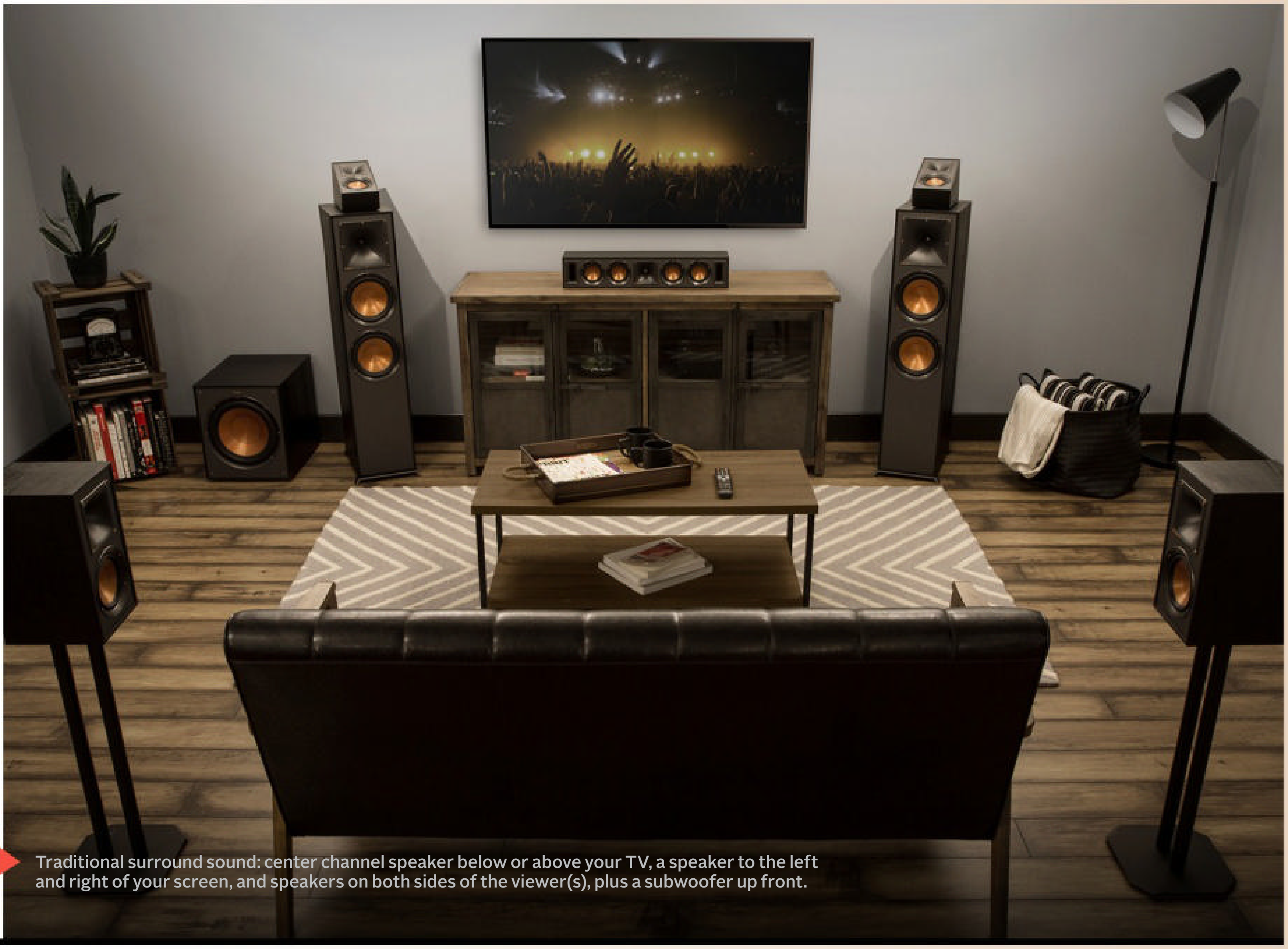
REMOTE POSSIBILITIES

Now that your room is set up, it's time to press play, relax, and enjoy the show. With all the systems involved, you could find yourself with too many remote controls, which not only creates clutter but also might confuse someone who is trying to operate your home theater.

The solution: a universal remote control that can handle basic functions as well as more advanced, such as communicating with your smart home devices and working with multiple brands of electronics.

ENJOY THE SHOW

With so many options available, it's easy to create a home theater that meets both your budget and room requirements—and, more importantly, one that allows you to escape distractions, accommodates the best video and audio you can buy, and ultimately makes you happy.



Traditional surround sound: center channel speaker below or above your TV, a speaker to the left and right of your screen, and speakers on both sides of the viewer(s), plus a subwoofer up front.

COURTESY KLIPSCH

// BY BRADLEY FORD //

RYOBI
ONE+ HP

Track Saws Help You Cut Straight, Like a Pro

NOT ALL THAT LONG AGO, TRACK SAWS WERE made by only a handful of companies and were employed almost exclusively by professional tradesmen. Designed to make long, straight cuts in sheet material—like plywood—these saws are more accurate and easier to use than table saws. But their singular purpose and high price (some more than $1,000) made them hard to justify for folks who need one only occasionally. That has all changed, though, as many companies have recently added track saws to their lineups. We called in a range of saws to test how well they work and see what their differences are, in case you're considering getting one yourself.

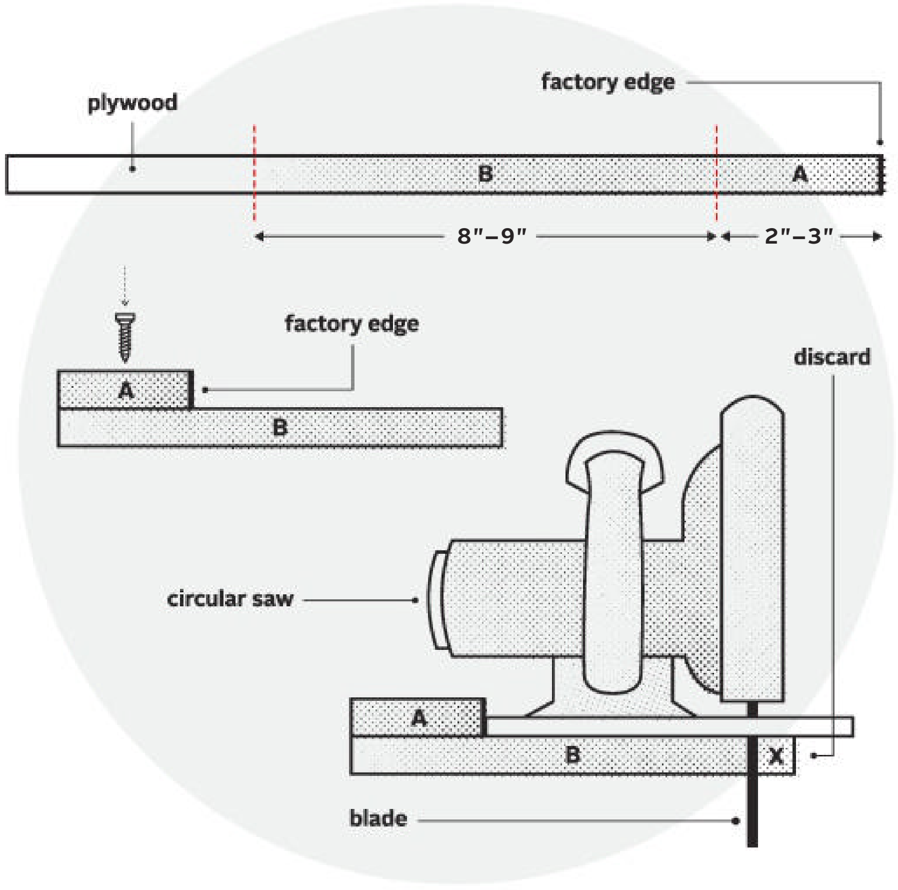
PHOTOGRAPHY BY THOMAS HENGGE

HOW WE TESTED

→ To evaluate these track saws, we used them to cut through dense, 2 x 4-foot, 9-ply, ¾-inch maple plywood. We set up the tracks, adjusted the saws' depths, and made repeated cuts 48 inches long at both 45 and 90 degrees. We started our cuts, both off the ends of the plywood and by plunging the blades into the wood. To test maximum cut depth, we stacked up three sheets of the ¾-inch plywood, set the saws to their deepest setting, and then measured how deep the kerf was for each saw. We assessed the track saws based on how easy they were to set up and use, the quality of the sawed edge they left, and how much effort it took to push them along the track.

DIY TRACK

If you want to mimic the accuracy of a track saw without the investment, you can build a makeshift track to use with your own circular saw. To do this, you'll need a sheet of plywood with a clean factory edge.



ELENI ARPINO (ILLUSTRATION)

1 / Mark the factory edge (A) and cut 2 to 3 inches off of it.

2 / Cut an additional 8 to 9 inches (B) off the sheet of plywood.

3 / Position the 2- to 3-inch strip (A) on top of and along the edge of the larger strip (B), with the factory edge facing the middle.

4 / Screw the narrow strip to the wider strip.

5 / Run the shoe of your circular saw along the factory edge (A), trimming a clean, straight edge on the bottom strip (B).

6 / Use this track by lining up the clean-cut edge on your measurement marks—then cut as you would with a commercial track. It's a good idea to clamp the track down to be sure it doesn't move while you're cutting.

WHEN AND HOW TO USE A TRACK SAW

Most frequently, track saws are used for cutting material that comes in large sheets, like plywood or paneling. While you can cut these sheets on a table saw, they can be unwieldy and difficult to handle, especially if you're working by yourself. By flipping the equation—moving the saw over the sheet instead of vice versa—you can achieve much greater control. And by guiding the saw with a track, you get much greater accuracy.

Aside from the track, the saw itself is a little different from a typical circular saw. With the blade retracted, above the shoe, you can position the saw flat on the track. Once aligned, you can plunge the blade down and push the saw along the track.

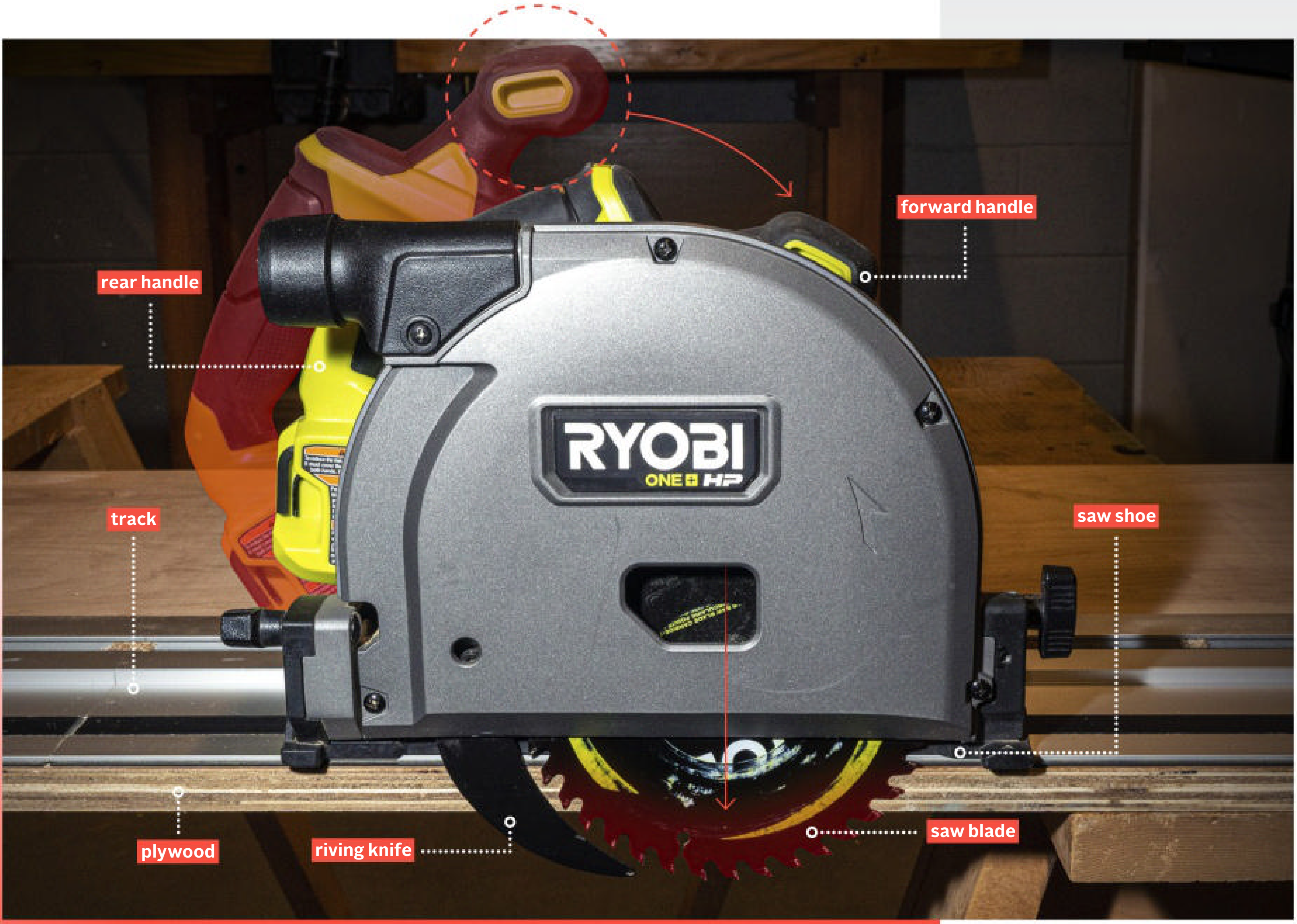
Track saws are accurate because the blade cuts even with the edge of the track. When you drop the track on your measurement marks, with the edge facing the waste side of the cut, the blade falls right on your marks.

HOW DOES THIS WORK?

There are two key features. The tracks have non-slip strips on the bottom that help prevent them from moving around. And since the saw is traveling perfectly straight, there's minimal friction on the sides of the blade.

OTHER USES

While setup can be tricky, some folks use track saws to install wood or laminate flooring. This requires care because, in many cases, the track will be wider than the flooring planks. So you'll have to set up a couple of planks to fully support the track and make sure it's stable before attempting to make your cut.



BEST OF THE TEST

RYOBI
ONE+ HP
BOSCH
Kreg

BEST CORDLESS KIT

RYOBI 18V ONE+ HP TRACK SAW KIT

★★★⯪☆

Price: $399 / **Blade size:** 6½ in. / **Motor:** 18 volt, cordless / **Battery:** 4 Ah / **RPM:** 4,300 / **Max cut depth:** 1 31/32 in. / **Riving knife:** Yes / **Case:** Soft / **Track:** 27½ in. (x2), included

Using the cordless Ryobi 18V One+ HP Kit was a welcome change from being tethered to an outlet. The saw was surprisingly powerful. Although it did take us longer to cut through three sheets of plywood, it didn't struggle. We started cuts at the end of the panel since, because the riving knife wraps under the blade, it couldn't plunge into the wood. We had to be mindful passing the saw over the seam in the track, as it could hang up. Cut quality was comparable with the corded models.

MOST POWERFUL

BOSCH GKT13-225L SAW AND FSN1600 63-IN. TRACK

★★★★⯪

Price: $589 (saw), $127 (track) / **Blade size:** 6½ in. / **Motor:** 120 volt / **Amperage:** 13 / **RPM:** 3,600–6,250 / **Max cut depth:** 2 1/32 in. / **Riving knife:** No / **Case:** Hard

On paper, Bosch's GKT13-225L was the most powerful track saw we tested. This was confirmed during our testing, as we pushed the saw easily through three layers of plywood, to a depth of 2 1/32 inches, without straining. We used the GKT13-225L with Bosch's 63-inch track, which stayed put, ensuring straight, accurate cuts. We found the depth and bevel settings simple to use, enabling us to make clean cuts at any angle.

BEST COMPLETE KIT

KREG ACS2000 ADAPTIVE CUTTING SYSTEM SAW KIT

★★★★☆

Price: $400 / **Blade size:** 6½ in. / **Motor:** 120 volt / **Amperage:** 12 / **RPM:** 2,000–6,000 / **Max cut depth:** 2⅛ in. / **Riving knife:** Yes / **Case:** Soft / **Track:** 62 in., included

Kreg's Adaptive Cutting System Saw Kit comes with everything. The 62-inch track is a one-piece affair that will work for many projects, but you'll want an extension for cutting anything longer. Kreg's saw had the deepest cut of any we tested, at 2⅛ inches, but required moving slower than with the Bosch. We appreciated the collection sock, which helped reduce the sawdust flying around.

Read about all the track saws we tested at popularmechanics.com.

// BY HUNTER FENOLLOL //

Valve's Steam Deck Makes PC Gaming Truly Portable

MOBILE GAME SYSTEMS HAVE LONG BEEN VIEWED AS inferior to gaming computers and consoles. That's because their smaller components are often too weak to keep up with the rising graphics demands of new titles. Traditional graphics cards and processors needed to handle the workload are expensive and large and run hot—relying on the space and power supply of a desktop tower. And if you want comparable strength on the go, you're looking at bulky gaming laptops with poor heat dissipation and battery life.

But the arrival of Valve Corporation's Steam Deck redefines what a gaming computer can be by creating a whole new category: affordable handheld gaming PCs. The Steam Deck condenses a powerful rig into an 11-inch portable system that weighs just 1.5 pounds.

PHOTOGRAPH BY TREVOR RAAB

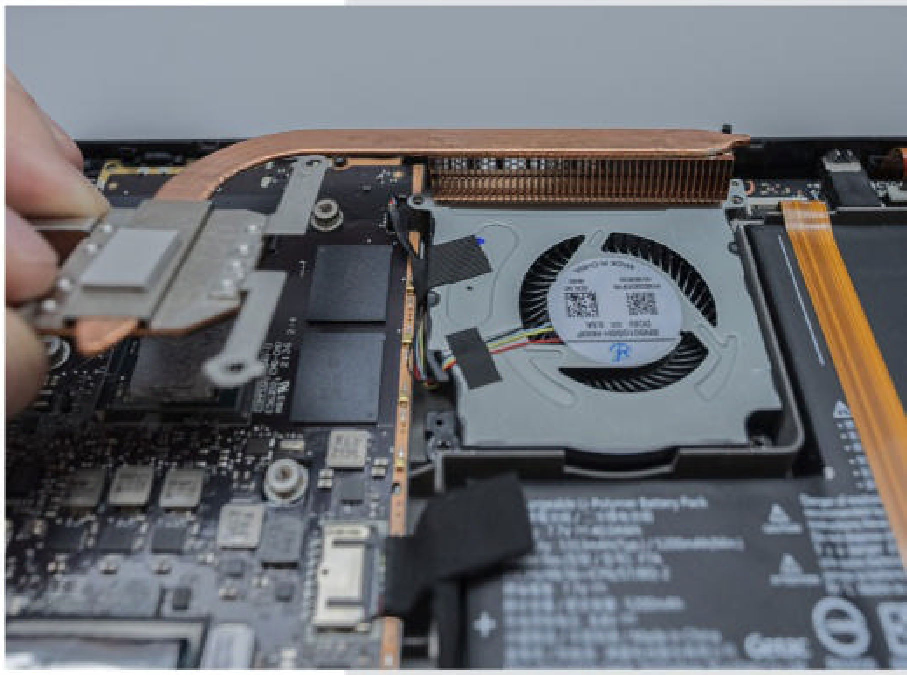
This all-in-one setup (from $399) combines a controller, touchscreen, and cooling system into a legitimate handheld computer that untethers the PC gaming experience from the desk. Its slick console-like interface makes it easy to pick up and play your library of computer games. And when you're home in front of your TV or gaming monitor, you can connect it to a USB-C hub to expand its connectivity and output its display to larger screens at higher resolutions. While it's easy to think of the Steam Deck as the computer equivalent of the Nintendo Switch, make no mistake, its capabilities are leagues ahead.

The Deck is more powerful for stronger graphics performance, while giving you the option to tweak visual settings. Meanwhile, it retains the unrestricted customization level of a PC—allowing you to install game modifications or even entire operating systems like Windows. Docking the device passively charges its battery while providing access to USB ports so you can use it as a desktop computer, complete with the option to connect a keyboard and mouse. The system also comes loaded with a Linux desktop mode for browsing the web or launching creative applications for tasks like making music, editing videos, or streaming live. Everything runs as smoothly within the Steam Deck's compact body as it does on a traditional desktop computer, which is an impressive feat for a device that has been a long time coming.

Valve got its start developing software ranging from games to applications such as Steam, its flagship program and the one the Deck is built around. This platform is part digital game storefront, part library, and part social media for computer gamers. Through it, Valve controls approximately 70 percent of the digital distribution market for PC gaming. "Valve is most valued on the revenue of its Steam digital content delivery service, which last year did over $6 billion in revenue," says tech industry analyst Anshel Sag. And this in turn provides the capital needed for hardware R&D.

The company has had its sights set on the Steam Deck since it began developing hardware 10 years ago. Valve's engineers toyed around with the concept of a handheld computer system while working on the Steam Controller—its hardware debut, which launched back in 2015. "We thought it would be cool if there was a screen in the middle, and we even had a prototype that included one," says Lawrence Yang, a User Experience Designer at Valve. "But the tech wasn't there yet, so we shelved the idea." Each successive hardware release—from the Steam Link to the Valve Index—contributed developments in ergonomics and display technology that laid the groundwork for the production of the Steam Deck. Over time,

COURTESY VALVE



How Valve Keeps It Cool

Computers require proper thermal management to remove excess warmth. Overheated components throttle gaming performance with lag and lost frames. The cramped guts of mobile devices can't withstand high temperatures nearly as well as the larger confines of desktop.

To address this, Valve built a thermal management system into the Steam Deck that uses a mix of software and just a single fan to cool multiple parts by specific amounts. "We can essentially allocate our cooling budget to each component by controlling the airflow path over the motherboard and the thermal coupling from that component," says programmer Pierre-Loup Griffais. This draws less power and makes for a lighter console without creating a distracting amount of noise.

Thermal control is left in your hands so you can toggle the energy usage limit directly from the Steam Deck's quick settings. This restricts how much wattage the processor uses. Lowering its levels keeps the heat down and extends battery life at the cost of performance. But for even deeper control, you can individually cap frame rates and refresh rates directly from the Deck's software.

Docking the Steam Deck expands its connectivity to larger monitors.

the components essential for a portable system shrunk down in both size and price to make the Steam Deck a reality. The final piece of the puzzle fell into place when Valve worked with semiconductor company Advanced Micro Devices to create a semi-custom, all-in-one processing chip called the Van Gogh to power the Deck.

Van Gogh is an Accelerated Processing Unit (APU) that bucks the energy and size demands required to run the Deck. An APU is a processor with built-in graphics. This saves on space and consumes less power than running two individual processor and graphics card components for better battery life. “This chip enabled Steam Deck to be performant enough to play the latest triple-A games but also incredibly power efficient with a great performance-per-watt ratio,” states Yazan Aldehayyat, an engineer at Valve.

Van Gogh stands out from other Systems on a Chip because it’s built on AMD’s RDNA 2 architecture, which also powers the latest generation of consoles. The result is powerful gaming performance that supports the newest display technology features like ray-tracing and AMD’s FidelityFX upscaling system. This runs games at a lower resolution to boost frame rates while retaining high amounts of detail.

But graphics settings aren’t locked down like they are with consoles, so players can push visuals to their limits at up to 60 frames per second. Still, cranking settings for stronger performance kills the battery faster. “Van Gogh isn’t as optimized for mobile form factors like the Steam Deck, which is why I think you see Valve offering so much granularity to users in terms of how much performance and battery life they want to get out of the device,” says Sag. If you simply want to play a game for as long as possible, you can use the suggested settings to slightly reduce graphics quality and frame rates to extend battery life.

In addition to the custom chip, the Steam Deck circuit board holding it is a feat in itself, as it’s densely packed to fit within the body. That posed a challenge, since the internal design needs to be laid out for both maximum breathability and repairability so DIYers can make replacements or hardware upgrades—a level of customization that’s a hallmark of PC gaming.

Steam Deck’s convenience and performance comes at the cost of color reproduction. The 1280x800 resolution is crisp on the small 7-inch LCD screen, which targets a modest 800p at 60 fps. However, if you hold it up next to a smartphone or Nintendo Switch with an OLED display, you can see just how flat colors can appear. True blacks on OLED screens are created by turning off individual pixels, which creates a stronger contrast than an LCD screen. This results in much more vibrant hues and inky blacks. The backlighting on the Steam Deck’s LCD screen makes blacks look gray, most distracting in dark scenes.

While a Steam Deck with an OLED display would be a welcome upgrade, its LCD screen is a small price to pay for a portable that runs the latest games. Valve sold over one million Steam Decks in just under a year from its release—showing the mass appeal of a handheld gaming PC. But its power for the price will be a tough act to follow. PM

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8

Editors' Choice

// ONE PIECE OF GEAR THAT'S WON THE HEARTS OF OUR TEST TEAM //

stoggles
POPULAR MECHANICS
EDITORS' CHOICE

▲ **Stoggles (with sports strap) | $49**

As a budding teenage carpenter, I was hit in the right eye by a flying finish nail. It was a miracle I didn't lose my eye or even suffer much injury. It was enough of a lesson that I've worn safety glasses ever since. Still, when I tried Stoggles—protective eyewear that's a hybrid between glasses and goggles, with side and top shields molded into the eyepiece—I liked their comfort most.

I've been wearing them for several months in our shop—testing tools and building projects—and find them so comfortable, I often end up wearing them at my desk (their Rx matches my reading glasses). That's thanks to their light weight and a fit that doesn't chafe my ears or the bridge of my nose. This says a lot about these glasses, because over the last 45 years, I've worn just about every form of protective gear, from welder's masks to standard safety glasses. Usually, I can't wait to take them off. But Stoggles are a breakthrough in lens clarity, fog resistance, ruggedness, and comfort.

If you are so inclined, you can buy pink, cat-eye-shaped Stoggles. But this is not dainty, fashion-first eyewear. Molded from polycarbonate plastic with an American National Standards Institute (ANSI) Z87.1 rating, they conform to ANSI's criteria to withstand both high velocity and high mass impact.

All these features add up to one important fact. No matter how good safety glasses are, they can't protect you if you don't wear them. And you'll want to wear these.—*Roy Berendsohn*

PHOTOGRAPH BY THOMAS HENGGE

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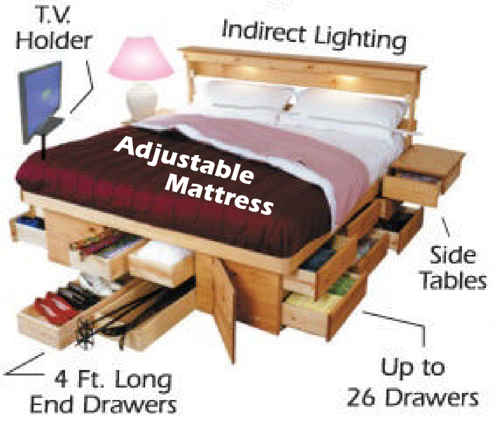
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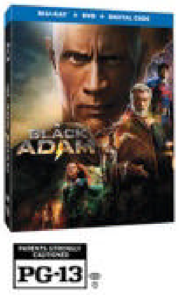

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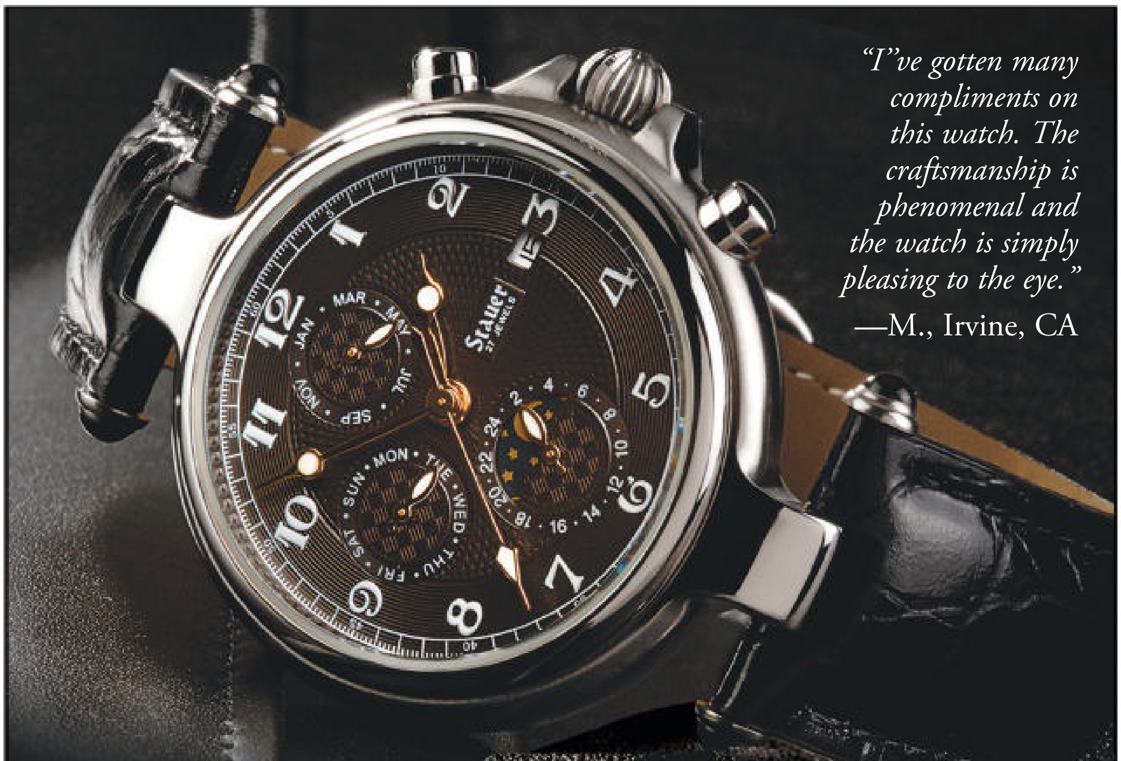

"I've gotten many compliments on this watch. The craftsmanship is phenomenal and the watch is simply pleasing to the eye."
—M., Irvine, CA

I'LL TAKE MINE BLACK… NO SUGAR

In the early 1930s watch manufacturers took a clue from Henry Ford's favorite quote concerning his automobiles, "You can have any color as long as it is black." Black dialed watches became the rage especially with pilots and race drivers. Of course, since the black dial went well with a black tuxedo, the adventurer's black dial watch easily moved from the airplane hangar to dancing at the nightclub. Now, Stauer brings back the "Noire", a design based on an elegant timepiece built in 1936. Black dialed, complex automatics from the 1930s have recently hit new heights at auction. One was sold for in excess of $600,000. We thought that you might like to have an affordable version that will be much more accurate than the original.

Basic black with a twist. Not only are the dial, hands and face vintage, but we used a 27-jeweled automatic movement. This is the kind of engineering desired by fine watch collectors worldwide. But since we design this classic movement on state of the art computer-controlled Swiss built machines, the accuracy is excellent. We have priced the luxurious Stauer ***Noire*** at a price to keep you in the black… only 3 payments of $33. So slip into the back of your black limousine, savor some rich tasting black coffee and look at your wrist knowing that you have some great times on your hands.

An offer that will make you dig out your old tux. The movement of the Stauer ***Noire*** wrist watch carries an extended two year warranty. But first enjoy this handsome timepiece risk-free for 30 days for the extraordinary price of only 3 payments of $33. If you are not thrilled with the quality and rare design, simply send it back for a full refund of the item price. But once you strap on the ***Noire*** you'll want to stay in the black.

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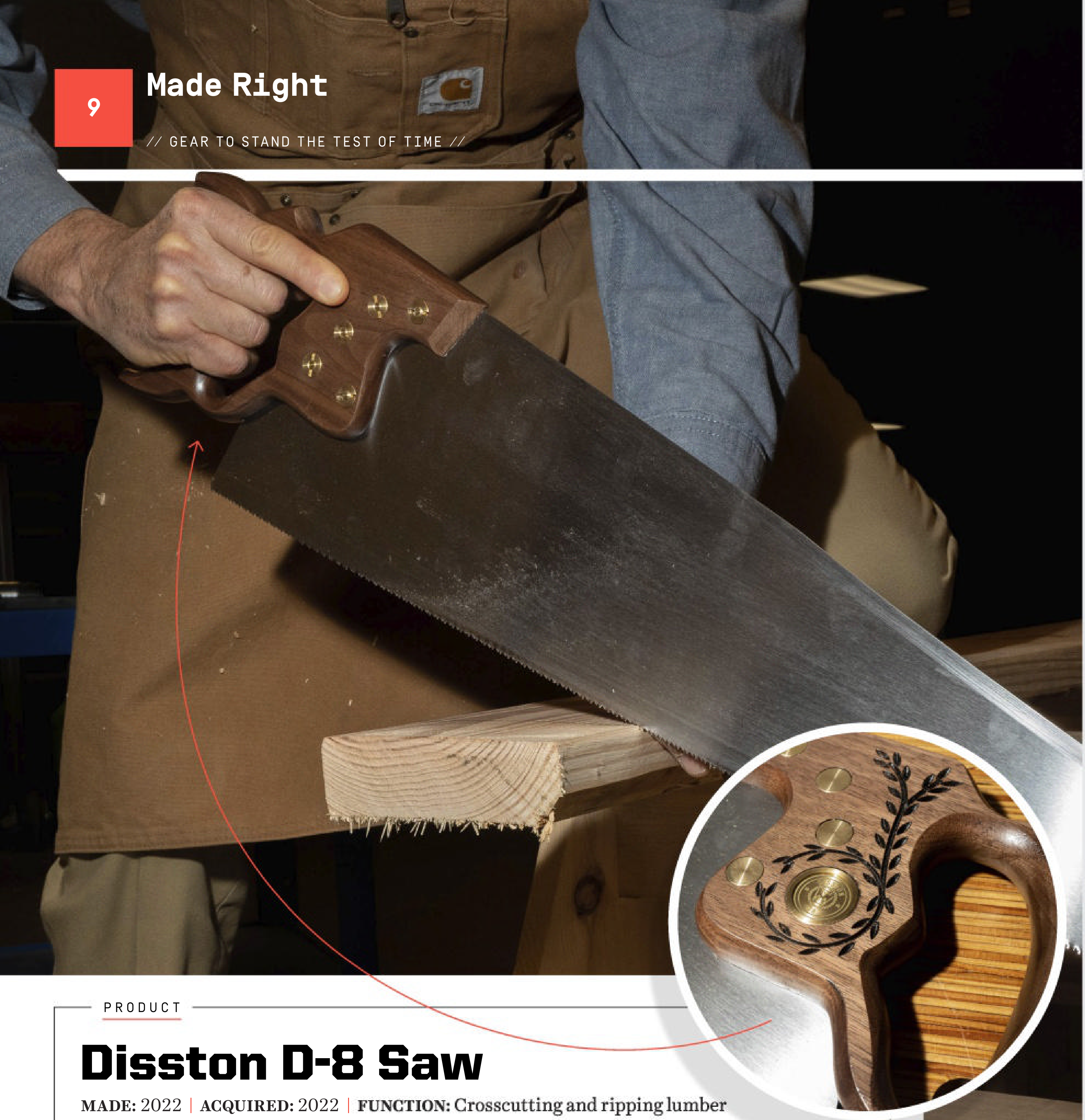

PRODUCT

Disston D-8 Saw

MADE: 2022 | **ACQUIRED:** 2022 | **FUNCTION:** Crosscutting and ripping lumber

WHEN I FOUND out that Disston Tools was working on a faithful reproduction of its famous D-8 handsaw, I was shocked. In this era of power tools, the company was reviving a saw that went out of production in the 1950s. And it was using the original factory drawings to guide the process.

When Disston introduced the D-8 in the 1880s, it was a new take on handsaws: light and small, easier to handle, and more suited to cutting framing lumber. But carpenters also loved the D-8 for its ability to follow a cut line. And the saw's superior metallurgy made it nearly indestructible. Old Disston ads showed how you could bend the blade into a U and have it spring back into shape.

I'm a hand-tool guy; I like their simplicity, their safety, and the visceral satisfaction that comes from using a sharp tool. So I carefully unwrapped the two D-8s: a fine-tooth crosscut saw (shown above) and a coarse-tooth ripsaw. I admired the graceful walnut handle with traditional brass screws and the subtle curve of the cutting edge.

I put a Douglas fir 2x8 across some sawhorses, marked a line, and cut it, marveling at how easily the crosscut saw churned through the lumber. I adjusted my stance and cut another block, then another, and another, and ended up sawing a whole pile of wood. Each block was dead-on accurate. What the old-timers said about the D-8 was itself dead-on: It cuts true.—*Roy Berendsohn*

PHOTOGRAPHY BY THOMAS HENGGE

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